SONY®

SERVICE MANUAL

AV-8600

COLOR
VIDEOCORDER

SONY CORPORATION

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SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION

This manual provides service information for the SONY AV-8600 Videocorder. It does not include information pertaining to special equipment applications, nor does it include instructions for performing factory-type repairs.

1-2. SPECIFICATIONS

Type EIA Japan type-1 video tape recorder

Video Recording System

Recording system:	Rotary two-head slant-track scanning
Luminance:	Fm recording
Color:	Converted subcarrier direct recording
Recording signal:	NTSC color signal or monochrome 2 : 1 interlace composite video signal based on American TV standards using EIA or industrial sync.

Operating Characteristics

Tape:	1/2 inch (12.7 mm) width on 7-inch reel maximum.
Tape speed:	7.5 inches per second (19.05 cm per second)
Recording time:	60 minutes (continuous) using SONY V-32 tape 30 minutes (continuous) using SONY V-31 tape
Rewind time:	Within 7 minutes for a full 7-inches reel
Operating position:	Horizontal only

Video Characteristics

Input:	0.5 to 2 V(p-p), sync negative, 75 ohms unbalanced, internally terminated.
Camera input:	0.5 to 2 V(p-p), sync negative, 75-ohm unbalanced, internally terminated, for SONY AVC series cameras.
Output:	1.0 V(p-p), sync negative, for a 75 ohms load, unbalanced.
Resolution:	Monochrome: More than 300 lines Color: More than 230 lines

Signal-to-noise ratio: More than 40 dB

Audio Characteristics

Microphone input:	−65 dB, 600 ohms, unbalanced
TV input:	−20 dB, high impedance, unbalanced
Auxiliary input:	0 dB, high impedance, unbalanced
Line output:	0 dB, 10 k-ohms, unbalanced
Frequency range:	80 to 10,000 Hz
Signal-to-noise ratio:	More than 40 dB
Flutter and wow:	Less than 0.2 % wrms

Camera Control Signal

V D :	60 Hz, negative pulse, 2 V(p-p) with 75 ohms load, unbalanced

General

Power requirements:	120 V ac (±10V), 60 Hz (±0.5 %)
Power consumption:	90 watts
AC outlet:	120 V, 500 watts maximum
Operating temperature:	32 °F (0 °C) to 104 °F (40 °C)
Dimensions	16-1/8″ (W) x 9-1/2″ (H) x 15-1/2″ (D) (410 x 243 x 393 mm)
Weight:	33 lb, 13 oz (17.6 kg)

1-3. OPERATING INSTRUCTIONS

PRECAUTIONS

1. To prevent accidental damage or needless wear to the video heads, observe the following.
   a. Do not operate the motor (Function Lever in FAST FORWARD, PAUSE, FORWARD, or REWIND position) unless tape is threaded properly on the machine.
   b. Never attempt to thread the tape while the motor is running.
   c. At the end of record or playback operations, set the Function Lever to STOP.
   d. Avoid leaving the motor running for extended periods while the tape is stationary.
   e. Do not operate the Function Lever if the tape is slack anywhere in the tape path.
2. To prevent erasure of a prerecorded tape, do not put the VTR in the record mode while the prerecorded tape is on the machine. Tape erasure takes place when the RECORD button is down and the Function Lever is in the FORWARD position.

Preliminary Setup

1. Press the POWER button. The pilot lamp will light.
2. Set the Tape Counter to 000 by pressing the reset button at the right of the counter.
3. Set the CAMERA/LINE/TV Selector according to the input signal.
4. Set the VIDEO MODE Switch to the COLOR or B/W position according to the recording signal.

Record Mode

1. To put the VTR into the "E-to-E" mode, press the red RECORD button down until it locks in the "down" position. The red RECORD indicator button will light.
2. Set the audio AGC/MANUAL Switch to the AGC (released) position. No adjustment of audio signal levels is required.

   Note: If manual level control is desired, set the audio AGC/MANUAL switch to MANUAL (depressed) position and, while watching the level meter, set the level control.
   Adjust the recording level so that the needle of the level meter does not swing past the red zone on sound peaks.
3. To start the recording, hold the RECORD button down while moving the Function Lever to FORWARD. This locks the RECORD button down in the record position. The automatic gain control system adjusts video and audio input levels automatically.
4. To stop the recording, move the Function Lever to the STOP position. The RECORD button is released and the VTR reverts to the playback mode.

Playback Mode

1. The VTR operates in the playback mode as long as the RECORD button is not depressed. Note that the monitor will display a snowy raster as the playback circuits have no input signals.
2. Set the VIDEO MODE Switch to COLOR or B/W according to the recording mode.
3. To play a prerecorded tape, set the Function Lever to FORWARD. The monitor will display the pictures previously recorded on the tape.
4. For stop action, set the Function Lever to PAUSE. The tape transport will stop and the monitor will display a still picture.
5. To skip over a portion of tape, move the Function Lever to the FAST FORWARD position. The tape will advance rapidly. To resume normal playback, set the Function Lever to PAUSE and then to FORWARD. Tape will move again at the normal playing speed.
6. To stop the playback operation, set the Function Lever to STOP.

SKEW Control

Picture distortion in the upper part of the screen may be corrected by turning the SKEW control. This knob automatically returns to its center position when the RECORD button is pressed.

TRACKING Control

Noise in the picture due to improper tracking may be corrected by turning the TRACKING control. For normal playback, turn the knob fully counterclockwise to the FIX position.

Sound Dubbing

To insert (dub) new sound onto a prerecorded tape, proceed as follows.

1. Connect a microphone (or other audio source) to the VTR. Refer to Section 1-4 for audio input connection.

> **Note:** When a microphone is connected, the auxiliary input at the AUX. IN jack is disabled.

2. Set the CAMERA/LINE/TV selector to CAMERA or LINE.
3. Play back the prerecorded tape. When the portion on which the new sound is to be added is seen on the monitor screen set the Function Lever to PAUSE. Push the AUDIO DUB button down and set the Function Lever to FORWARD again. Sound dubbing will start.
4. At the end of the dub, set the Function Lever to STOP.

Playback on a Conventional TV

A conventional TV receiver can also be used for playback display by adapting the RF Unit (optional) to the Videocorder.

1. Remove the cover of the RF Unit compartment.
2. Insert the RF Unit (RFU-103FW or 104FW whichever channel is inactive in your area) into the compartment and connect the Videocorder, Antenna Selector and TV receiver as shown in Fig. 1-1.

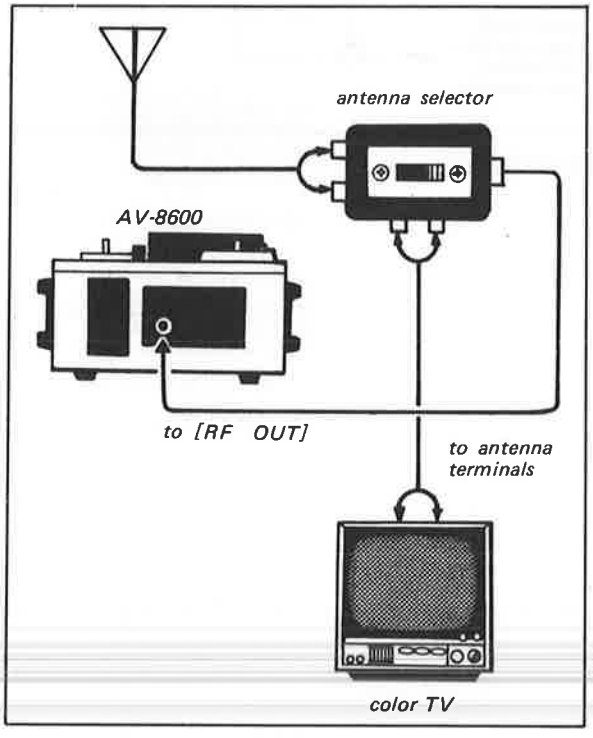


Fig. 1-1. RF unit connections

3. Set the ANT/VTR switch on the Antenna Selector to VTR.
4. Set the TV channel selector to the channel to which the RF Unit is set.
5. Set the Videocorder to the playback mode.
6. Adjust the fine tuning knob for the best picture.

1-4. INPUT/OUTPUT CONNECTIONS

Figure 1-2 shows all input and output terminals, and output-signal characteristics. Normal connections to the monitor are made at 8-pin jack marked TV. Normal camera connections are made at the 6-pin CAMERA receptacle. Signal and power connections to other accessory equipment are as shown.

A. Power Cord Receptacle [AC IN 120V 60 Hz]. Connects to a three-wire (parallel-ground) ac receptacle.

B. Power Output Receptacle, unswitched [AC OUT 500W]. Line output to power a monitor or camera. Max. rating 500 watts.

C. TV-Monitor Jack [TV]. Provides all signal connections to and from the monitor. See detail.

D. Fuse [2A] Contains a 2-ampere fuse.

E. Audio Out Jack [LINE OUT]. Provides an additional audio-output feed to supply playback monitors or other audio components. Signal level: 0 dB (0.775 V) across high impedance. This jack is in parallel with pins 1 and 5 (5 grounded) of the TV jack.

F. Auxiliary Input Jack [AUX. IN]. Provides an alternative audio input for high impedance microphones, studio feeds, record players, and other audio sources. Signal level requirements: 0 dB across high impedance.

G. Microphone Input Jack [MIC IN]. Signal feed point for a SONY microphone or other microphone with similar characteristics. Signal level requirements: −65 dB, 600 ohms, single ended.

H. Camera Jack [CAMERA]. Provides video and sync connections to the camera. See detail.

I. UHF Input Connector [VIDEO IN]. Provides video input connection for a camera or TV monitor equipped with a video-output UHF connector.

J. UHF Output Connector [VIDEO OUT]. Provides an additional video-output feed to supply a monitor having a video-input UHF connector.

K. UHF Output Connector [RF OUT]. Supplies output to the antenna terminals of a conventional TV receiver when the RF unit is used.

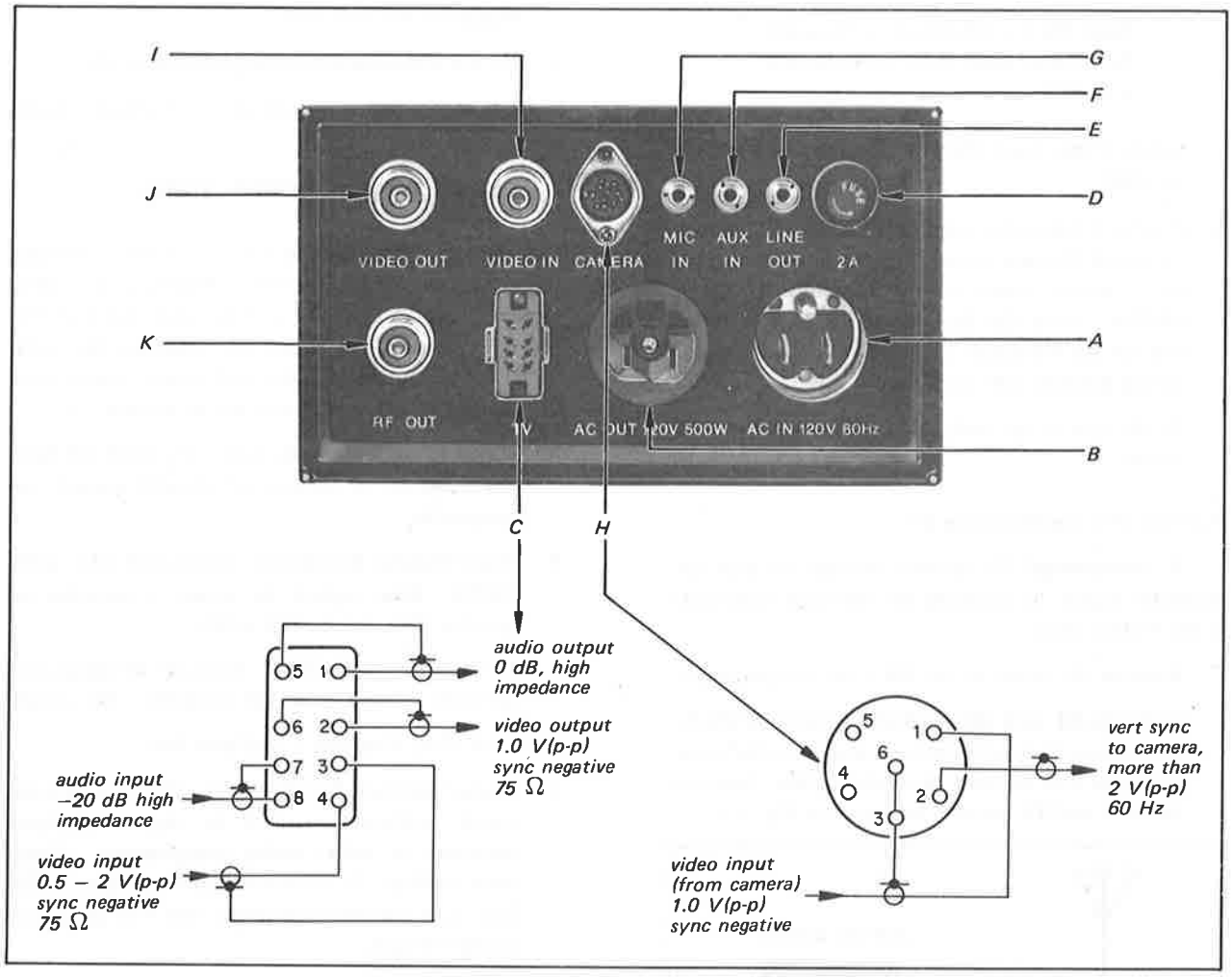


Fig. 1-2. Input/Output connections

SECTION 2
CIRCUIT DESCRIPTION

2-1. GENERAL

Circuit components of the AV-8600 consist of the luminance, color, servo, and audio systems, and regulated power supply. The luminance circuits are located on the VM1 and VD1 boards, the color circuits on the MC1 board, the servo circuits on the SV board, and the audio circuits on the A2 board. The regulated power supply is on the R4 board.

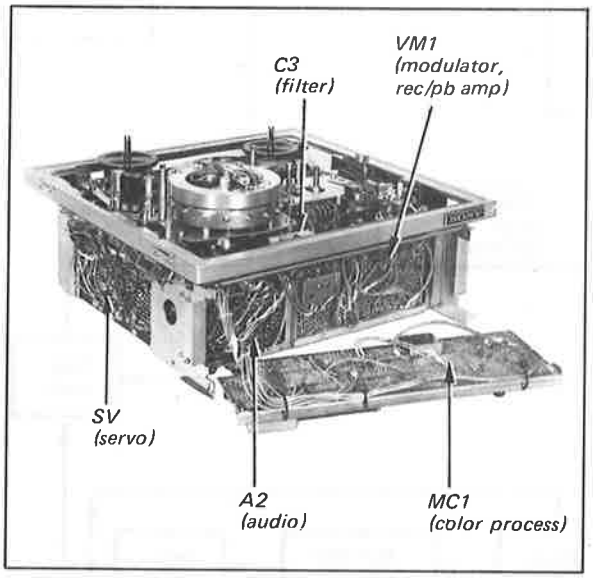


Fig. 2-1. Location of printed circuit boards

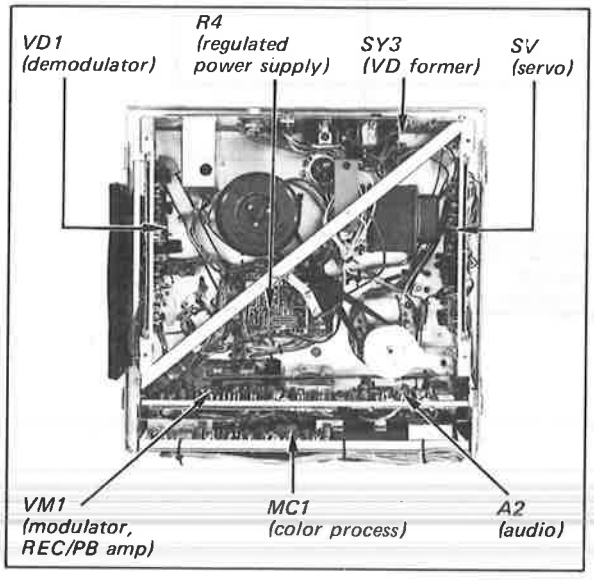


Fig. 2-2. Location of printed circuit boards

2-2. COLOR RECORDING SYSTEM

NTSC color video information is recorded on the magnetic tape in the form of sidebands of a frequency-converted color subcarrier.

The incoming NTSC composite color signal is separated into luminance and chrominance signals by filters. The luminance signal is frequency modulated by an fm modulator. The chrominance signal, that is, the color subcarrier, is frequency-converted (shifted) to a 767 kHz carrier by heterodyning it with an internally generated 4.34 MHz local oscillator. The Y (luminance) -fm carrier (3.3 MHz ~ 4.7 MHz) and the frequency-converted color subcarrier (767 kHz) are combined and recorded onto the tape. See Fig. 2-3.

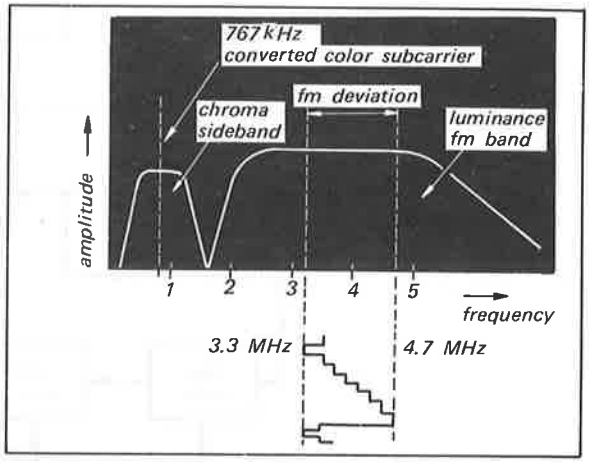


Fig. 2-3. Frequency spectrum of rf signal recorded on the tape

During playback, the reproduced rf signal from the head is separated into the Y-fm signal and 767 kHz color subcarrier. The 767 kHz color subcarrier is reconverted to the original 3.58 MHz color subcarrier using the reproduced burst signal as a frequency reference; it is then mixed with the demodulated Y signal. Thus, the original NTSC color composite signal is reproduced.

The color recording system affords several advantages. It accomplishes the recording of the NTSC signal within the effective VTR bandwidth by shifting the color subcarrier to a lower band. It cancels hue variations (phase variations of the reproduced color subcarrier) due to mechanical fluctuations in the tape transport. Also, it is compatible with black-and-white signals.

Refer to the simplified overall block diagram.

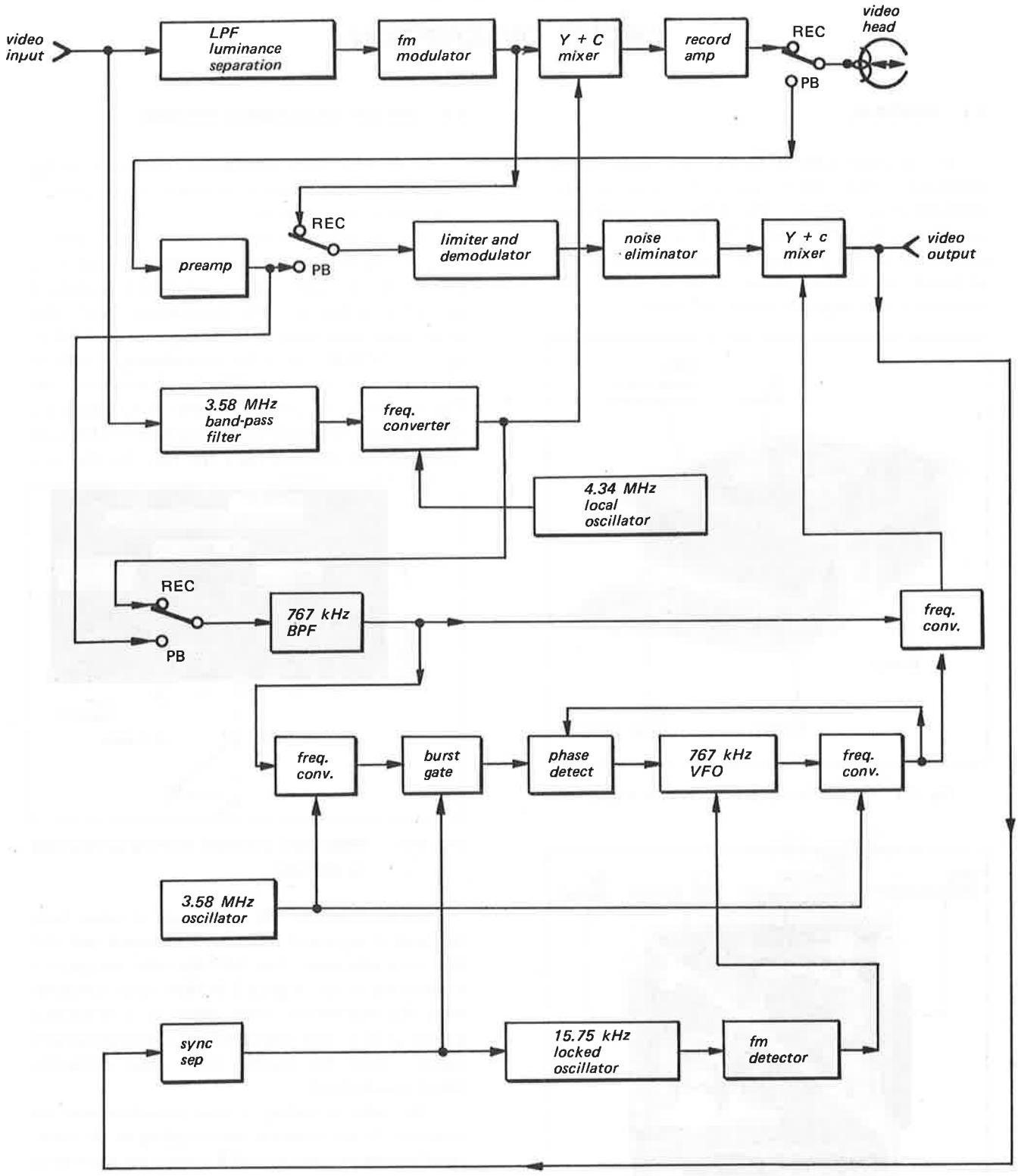


Fig. 2-4. Video system overall block diagram

Recording

The luminance signal is separated from the input NTSC signal and fed to the Y-fm modulator circuit. See Fig. 2-5.

The elimination of the color subcarrier prevents undesirable interference in the color reproduction process. The frequency-modulated Y signal is cut off at the low end of the band (1 MHz) by a high-pass filter, since the converted 767 kHz color subcarrier is placed in the lower band. The separated chrominance signal is supplied to the color processing circuit through a 3.58 MHz bandpass filter, and fed to the frequency converter. This converter changes the frequency of the color subcarrier from the original 3.58 MHz to a new 767 kHz using an internally-generated 4.34 MHz local oscillator. Frequency stabilization of the local 4.34 MHz oscillator is essential for stable color reproduction and also to maintain tape interchangeability between machines. The converted color subcarrier is combined with the Y-fm signal at a level of −13.5 dB with respect to the 0 dB Y-fm signal, and recorded on the tape. The signal-to-noise ratio of the color subcarrier is sufficient, since the Y-fm carrier serves as a-c bias for the color subcarrier as in audio recording.

Playback

The playback preamplifier amplifies the video head output and equalizes playback characteristics to provide a flat response throughout the r-f spectrum. A pair of filters separate the playback r-f into the Y-fm carrier and the color subcarrier.

The Y-fm signal is cut-off at the low end of the band and demodulated to reproduce the original luminance signal. It is delayed about 0.7 μsec so that the Y signal and chrominance signal arrive at the output at the same time. (This also holds true for the E-to-E mode.) The separated playback chrominance signal consists of sideband information grouped on both sides of a 767 kHz center frequency. These signals are subject to frequency and phase errors introduced by minute time-base errors inherent in the record-playback processes of a video tape recorder. The video tape recorder has two loop circuits to cancel the frequency and phase errors. One loop is the automatic phase control circuit (APC, see Fig. 2-6 and Fig. 2-7). The other loop is the automatic frequency control circuit (AFC, see Fig. 2-8).

APC loop

The basic concept of the APC loop is to heterodyne the reproduced 767 kHz sidebands against a 4.34 MHz source that has identical phase errors.

The reproduced 767 kHz color subcarrier contains jitter components the frequency of which are converted to 4.34 MHz using a stable 3.58 MHz oscillator, so that it can cancel the phase error that is induced in the record/playback process.

The newly-produced 4.34 MHz is used to convert the 767 kHz signal to 3.58 MHz. The result is a constant-difference frequency centered about the NTSC subcarrier of 3.58 MHz. See Fig. 2-6.

Details of the APC loop are shown in Fig. 2-7.

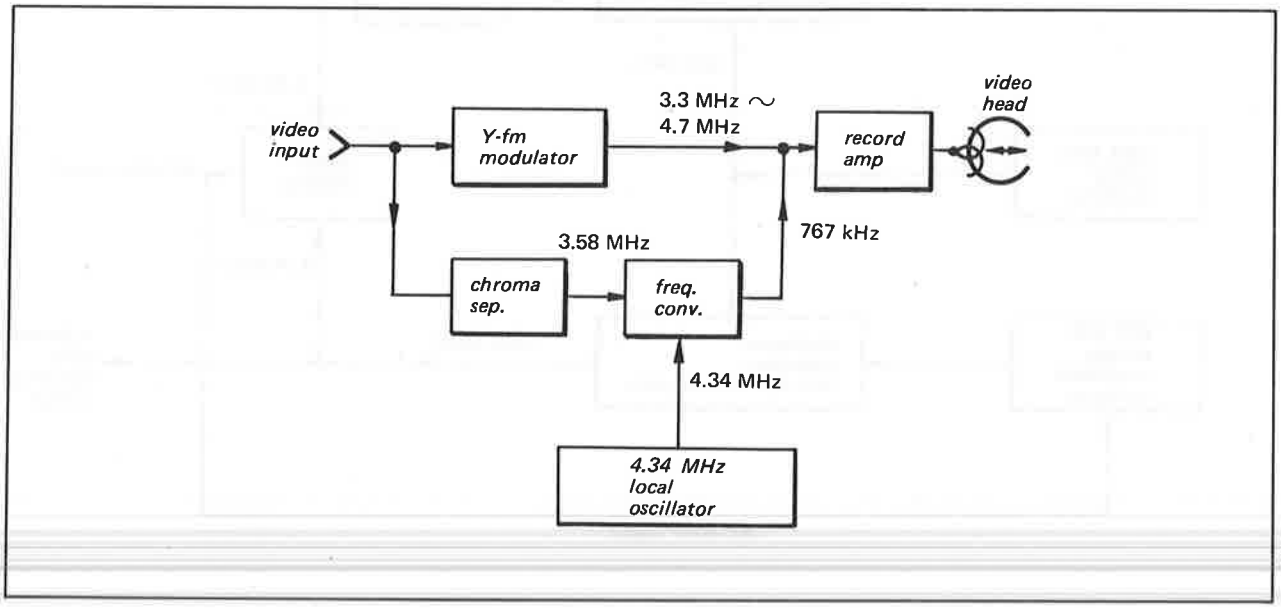


Fig. 2-5. Record mode, block diagram

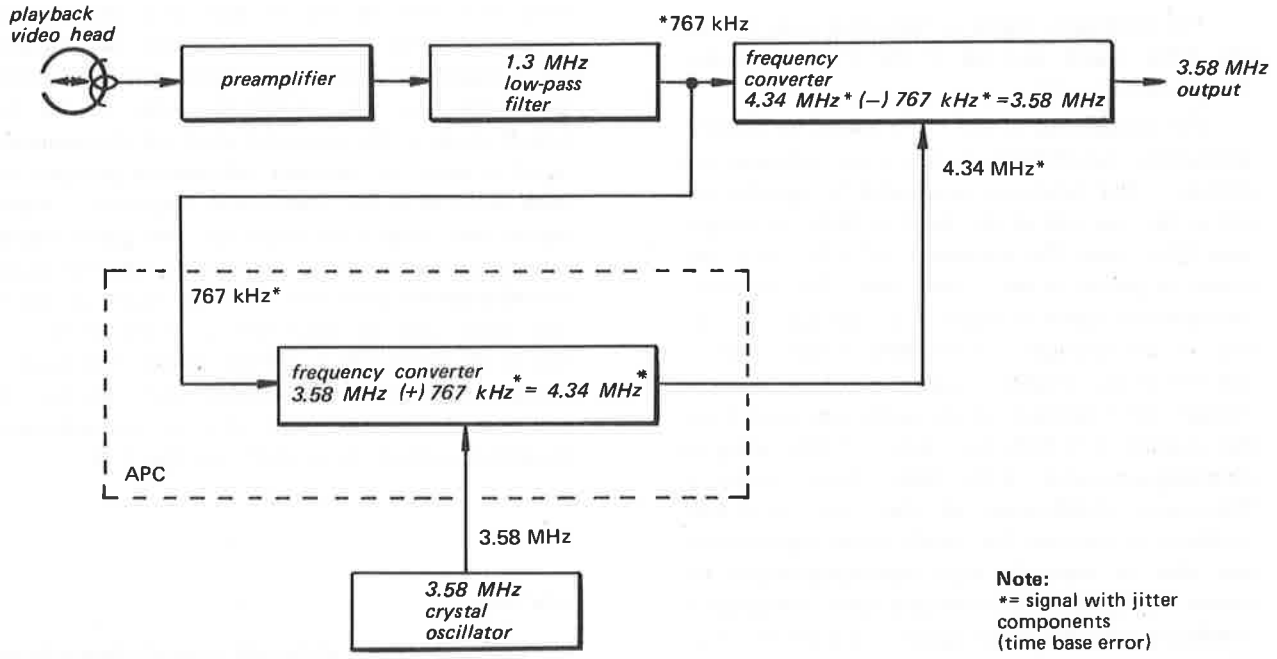


Fig. 2-6. Simplified block diagram of APC loop

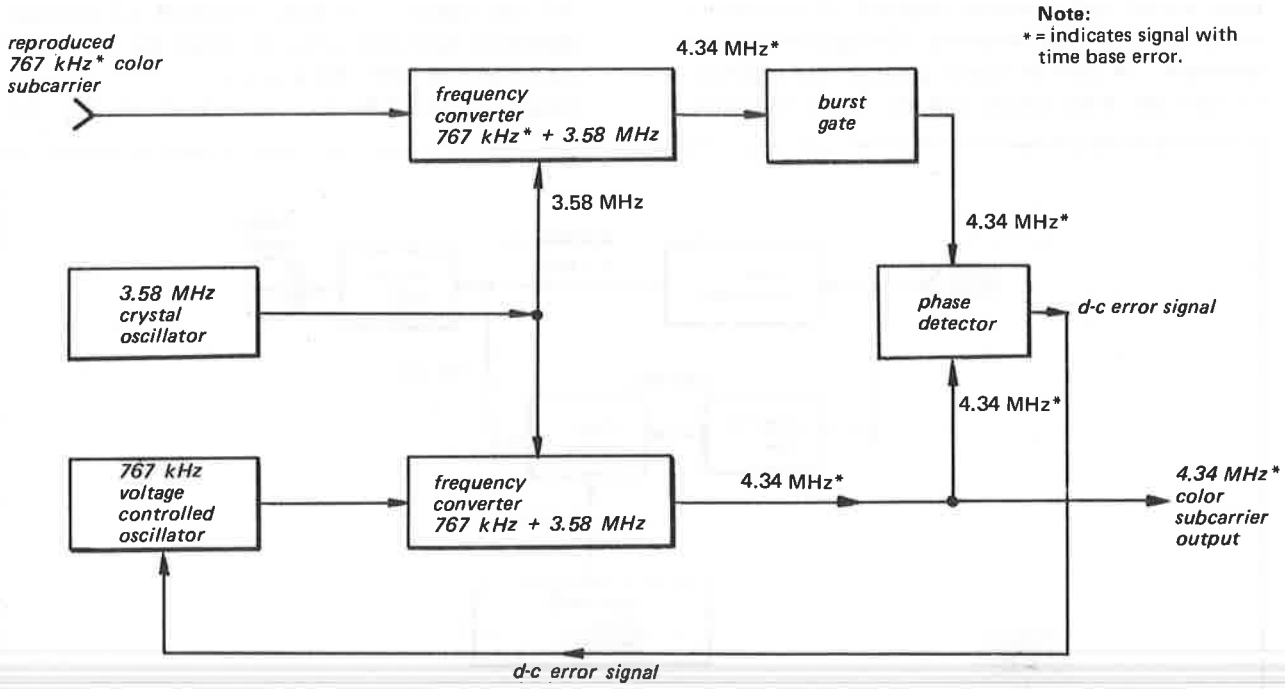


Fig. 2-7. APC loop block diagram

The reproduced 767 kHz* signal is converted to 4.34 MHz* using a stable 3.58 MHz. The output 4.34 MHz contains the time base error. This signal is then sent to a burst separator where the 4.34 MHz burst signal is extracted. The separated burst signal also shows the time base error. At the same time, an independent voltage-controlled 767 kHz oscillator supplies a stable 767 kHz single tone that is converted to 4.34 MHz using a crystal-controlled 3.58 MHz signal. Phase comparison between the stable 4.34 MHz CW signal and 4.34 MHz* burst containing phase error takes place in the phase detector. This detector develops as d-c error signal that is proportional to the phase difference, which is used to control the phase of the 767 kHz voltage-controlled oscillator.

Response of this APC loop is fast enough so that it can follow the phase errors introduced in record/playback processes.

AFC loop

In the STILL and SLOW-MOTION modes of operation, the head-to-tape relative speed is decreased by 2 % so that the frequency of reproduced color subcarrier, 767 kHz, is also decreased by 2 %. This frequency change can be compensated for by the AFC loop, not the APC loop. The AFC loop uses the reproduced 15.75 kHz horizontal sync signal. Frequency variations in the 767 kHz color subcarrier and the reproduced horizontal sync signal are of the same amount since they are subject to the same variations in time base. The frequency variations of the reproduced sync signal are detected by an fm discriminator circuit, the output of which is a d-c signal that is proportional to the frequency deviation from 15.75 kHz. The d-c output signal is then routed to the 767 kHz voltage-controlled oscillator in the APC loop. See Fig. 2-8.

The demodulated video signal in Fig. 2-8 is obtained from the demodulator output of the luminance circuit, and feeds the sync separator circuit. Horizontal sync is extracted and triggers the 15,750 Hz phase-locked oscillator that produces a 15,750 Hz CW signal. When the tape-to-head relative speed is decreased as in the slow and still modes, the frequency of the CW signal is also decreased and amount of the decrease is detected by the fm discriminator. The fm discriminator has a reverse S-curve characteristic that develops a higher d-c output signal when the head-to-tape relative speed is decreased. The d-c output is supplied to the 767 kHz voltage-controlled oscillator.

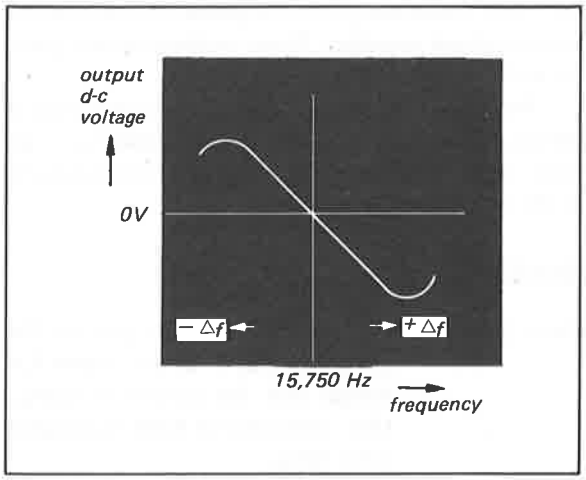


Fig. 2-9. Characteristic curve of the fm discriminator

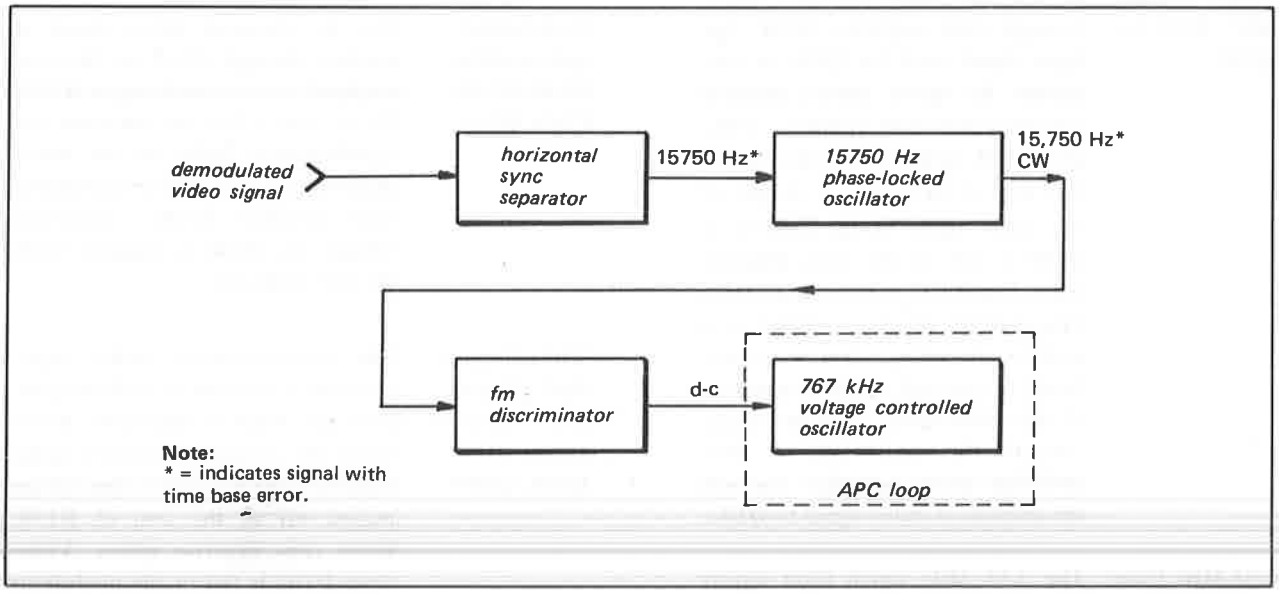


Fig. 2-8. AFC loop block diagram

2-3. BLACK & WHITE VIDEO CIRCUITS

A step-by-step description of the monochrome video circuits is given in this section.

Video information is recorded on the tape in the form of a frequency-modulated carrier. The video circuits on the VM1 and VD1 boards process the video signal during record and playback operations.

In the record mode the video input is supplied to the VM1 board, where it is gain-controlled automatically, clamped, pre-emphasized, white-clipped, dark-clipped, fm modulated, and supplied to the record amplifier.

The video output signal from the record amplifier is supplied to the video heads through the slip rings and is recorded on the tape.

In the playback mode the recorded signals from the rotary heads are fed to the playback preamplifier and are mixed together. These continuous fm signals are fed to the VD1 board.

The circuits located on the VD1 board include a limiter, differentiator, rectifier and demodulator. The video output from the VD1 board is a reproduction of the original video signal.

Stage/Control	*Function*
Video Input	Pin 4 of the TV (8-pin) jack for TV recording. Pin 1 of the CAMERA (6-pin) jack for camera recording. UHF connector for LINE (auxiliary) video input.
Video Amplifiers and AGC Q101 to Q104	The incoming video signal is supplied to the first video amplifier Q102 through AGC amplifier Q101. The input signal level for Q102 is controlled by Q101 (FET) without manual video level control. Q102 and Q104 amplify the video signal and feed it to Q105. A sample of the video signal at the emitter of Q105 is fed to the peak detector consisting of C112, D101, and D102. The output of the rectifier is a positive dc voltage that is proportional to the peak white component of the video signal. This dc voltage controls the conduction of AGC amplifier Q101 and this controls the amount of input signal to Q102.
3.58 MHz Filter and Switcher L101, C106	The 3.58 MHz notch filter rejects the 3.58 MHz color subcarrier by grounding it through Q103 in the color mode of operation. The switcher transistor is on in the color mode as its base receives bias and is driven into conduction.
Low Pass Filter L102, L103, L104, L111, C113 and C114	The low-pass filter rejects the video signals at the high end of the band, such as the 3.58 MHz color subcarrier and the 4.5 MHz audio i-f signal. C113 and L111 form another filter for 3.58 MHz. L111 is disabled in the black and white mode of operation as switching transistor Q120 is turned on, so that the filter tuning frequency is shifted to a high frequency for broad bandwidth.
Deviation Setting and Clamp R123, Q106, D103, R129	The output of the low pass filter is supplied to Q106 through R123. R123 sets the video signal level to Q106 so that the following fm modulator produces an fm signal of 1.4 MHz deviation, from 3.3 MHz to 4.7 MHz. D103 clamps the sync tip of the composite video signal to the reference voltage picked off at the arm of R129. This reference voltage sets the sync tip (or no-signal) frequency of the fm modulator. R129 is set to establish the sync tip carrier frequency of 3.3 MHz.
Pre-emphasis and amplifiers R133, R134, C119, Q107, Q108	The dc clamped video signal is applied through Q107 to the pre-emphasis circuit consisting of R133, R134, and C119 to improve the signal-to-noise ratio of the video information, and then to grounded-base amplifier Q108. Base-bias voltage for Q108 is supplied from the arm of Q129.
White Clipper, Dark Clipper, and Modulator Driver D104, D105, Q109	The pre-emphasized video signal contains overshoot in both the positive and negative directions. D104 limits the maximum positive signal (white peaks) of Q108 to the voltage picked off at the arm of R139. D105 clips negative spikes. Video from D104 is fed to the modulator through modulator driver Q109.

Stage/Control	*Function*
Modulator Q110, Q111	The modulator is a free-running symmetrical multivibrator. Frequency control is achieved by returning both bases to the low-impedance source of modulating voltage—the emitter of Q109 through R144, Frequency varies from the tip-of-sync value of 3.3 MHz to a maximum 4.7 MHz for peak white signals. R155 and C124 are adjusted to obtain a symmetrical output waveform (equal pulse durations and slopes for each half cycle). Waveform symmetry is important as it determines the extent to which carrier energy can be removed from the demòdulated signal. The push-pull modulator output is converted to a single-ended feed by T101.
High-pass Filter and Color Switching C132, C133, L108, Q112, Q114	The single-ended output of the modulator is amplifier by Q113, the output of which has two paths. In the color mode, Q112 is turned on, routing the luminance modulated carrier through the high-pass filter to the COLOR-B/W selector on the SW3 board. The high-pass filter rejects frequencies below 1.3 MHz. In the monochrome mode, Q114 is turned on and routes the luminance modulated carrier, without bandwidth limiting, to the COLOR-B/W selector.

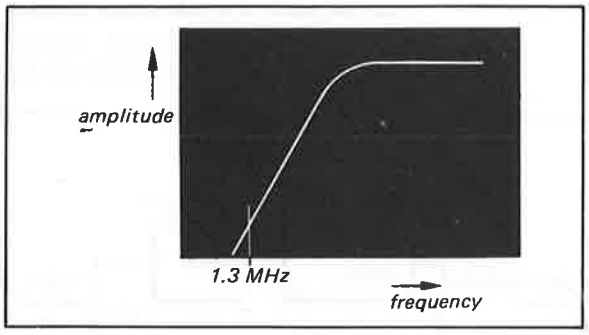


Fig. 2-10. High-pass filter

Record Amplifiers Q116, Q117, Q118, Q119	The fm signal from the modulator is applied to record amplifiers Q116 to Q119 via the COLOR-B/W selector and buffer Q115 of drive the video heads. In the color mode of operation, the 767 kHz converted color subcarrier is added to the luminance modulated carrier at the input to the record amplifier. The record amplifiers operate in the Record mode only, as B+ is switched off in all other modes. R174 and R182 adjust the recording current applied to the video heads for optimum recording level.
Video Heads	A slip-ring and brush assembly couples recording current to Video Heads A and B. The Video Heads supply signals during playback operations. The angle between the heads is 180° ± 20".
Playback Amplifiers Q201, Q203, Q202, Q204	Outputs from the video heads are coupled through T201 and T202 (load ratio 1 : 1) to their respective playback amplifiers. The low-noise cascode amplifier Q201 (Q204, FETs) and Q202 (Q205) amplify the weak signals. A resonant circuit in the gate of Q201 (Q204), consisting of T201 (T202), R201 (R202), and C201 (C202), resonates with the reactance of the head and increases the output from the head at the resonant frequency to provide high frequency compensation for head-to-tape characteristics. Inductor L203 in the collector of Q202 (Q205) keeps the dc collector level constant, and also forms a trap with R205 to keep the audio bias/erase signal out of the playback amplifiers during audio dub operations.
Switchers and Mixer Q203, Q206, Q207	Channel A switching transistor, Q203, is employed in the source of Q201. Similarly, Channel B employs switching transistor Q206 in the source of Q202. The states of Q203 and Q206 are always opposite. For example, when Q205 is saturated, Q206 is cut off by the opposite-phase rectangular switching pulses from FF401 (hybrid IC). When Q203 is ON, the source of Q201 is shorted to ground, so that Q201 can amplify rf signals. Output from

Stage/Control	*Function*
	Head A is amplified by Q201 and Q204, and routed to the following playback amplifiers during positive excursions of the switching waveform. While output of Video Head A is gated, the output of Video Head B is blocked from the playback amplifiers. This is done as follows: When Q206 is cut off (Q205 ON), the cascode amplifier of Channel B can not amplify Head B output because of the high impedance (L202) in the source of Q202. The conditions described above are reversed with each 180° rotation of the head drum by the signals from two 30 PG coils mounted on the scanner. Thus, the output of each head is alternately coupled to Q207 and combined into a continuous rf signal without any noise.
Equalizing Amplifiers Q208, Q209	The rf signal from Q207 is amplified by Q208 and fed to the limiters through Q209. The collector circuit of Q208 contains a resonant circuit consisting of R211, L204, and C211 which provides playback equalization. R211 and L204 set the resonant frequency to about 3.5 MHz for correct playback equalization.
Limiters Q301 to Q305, D301 to D310	The limiter stages eliminate amplitude fluctuations caused by variations in head-to-tape contact. Limiting is accomplished by the four diode pairs with interstage amplification supplied by transistors Q301 to Q305. Each diode conducts when the signal across it reaches about 0.4 V(p-p) in the forward direction. Thus, the signal is limited in both directions to 0.8 V(p-p). In the last stage D307/D308 (D309/D310) conduct when the signal exceeds 0.7 V(p-p) signal, so that 2.8 V(p-p) is developed across the combination D307 and D308 (D309 and D310).
Demodulator D311, D312, Q306, LPF	The input to the demodulator is differentiated by R326 and the primary winding of T301. The push-pull output of T301 is applied to a frequency doubler consisting of a pair of pulse detectors D311 and D312. They conduct on alternate half cycles to produce two positive output pulses per input cycle. Thus, carrier frequency is effectively doubled and placed outside the video passband. By integrating the pulse output in the low-pass filter that follows Q306, a video output is obtained that is proportional to pulse frequency. R329 is set to balance the pulse output of the frequency doubler. R332 and C317 reduce high-frequency gain to provide de-emphasis.
Noise Eliminator Q309, Q310, Q311, D313, D314	The demodulator output signal is supplied to the input of the Y-noise eliminator where it is separated by high-pass and low-pass filters into high-frequency and low-frequency components. Separated low-frequency components are amplified and supplied directly to a mixer circuit. Separated high-frequency components are amplified and supplied to a diode slicer circuit. The slicer circuit consists of two back-to-back diodes connected in parallel and removes all noise lower in amplitude than the diode conduction level. The slicer output is again amplified and supplied to the mixer circuit where low-frequency components and high-frequency components less noise are mixed to re-

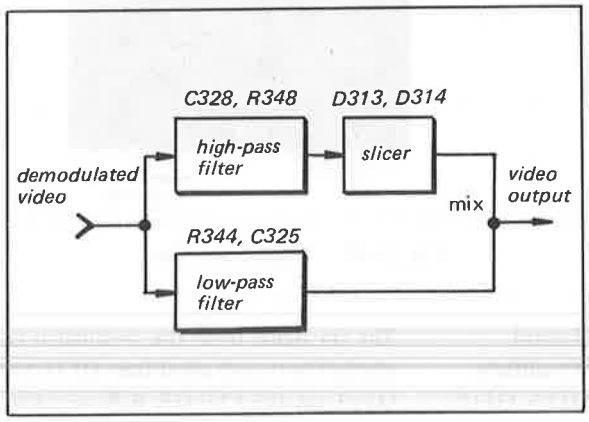


Fig. 2-11. Noise eliminator

Stage/Control	*Function*
	produce the original video signal without the noise. The noise eliminator output is routed to the MC1 board in the color mode and directly to the video out stage in the monochrome mode of operation. In the color mode, the demodulated video signal is delayed by 0.7 μs, passed through a low-pass filter where the high frequency range of 3.58 MHz is rejected before the color subcarrier is mixed, and then amplified by the output amplifier.

2-4. COLOR PROCESSING CIRCUIT

Color processing circuits are located on the MC1 board. They separate the chrominance signal from the input NTSC signal and convert it to a lower frequency. These circuits also restore the original 3.58 MHz color subcarriers for E-to-E and playback operations, and generate the 4.34 MHz crystal-controlled signal. System description is given in section 2-2. A step-by-step description is given below.

Stage/Control	*Function*
3.58 MHz Filter C101, R101	The filter separates the 3.58 MHz chrominance signal from the input color signal and feeds it to the automatic chroma level control circuit (ACC), Q101.
ACC Q101, Q102	The output level of Q101 is controlled automatically by Q102 (in the emitter of Q101) to provide a burst signal of constant amplitude to the following color processing circuits. A dc voltage proportional to the level of the input chrominance signal controls the conduction of Q102 and this adjusts the gain of Q101.
Modulator Driver Q103	This emitter follower provides the 3.58 MHz signal from the ACC to the balanced modulator and burst gate Q109.
Pulse Amp Q108	The separated sync signal is supplied from the SV board to Q108 where sync is amplified to drive the burst gate circuit.
Burst Gate Q109	For the duration of the horizontal sync pulse, the chrominance signal applied to the base of Q109 is sampled and appears at its collector. Since the burst interval is in phase with the horizontal sync by adjusting L104, the burst signal is obtained at TP-106.

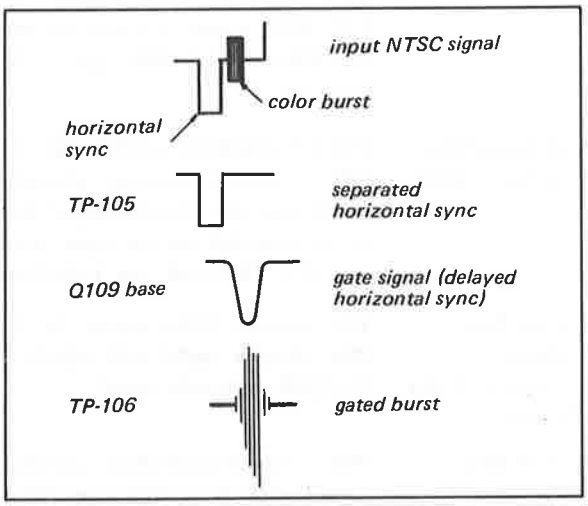


Fig. 2-12. Burst gate waveforms

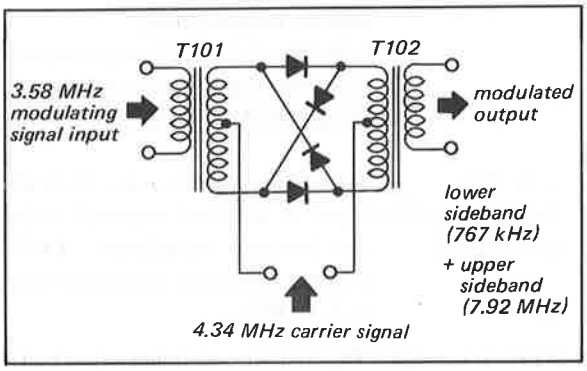


Fig. 2-13. Balanced modulator

Stage/Control	*Function*
Burst Detector D106, T103, R140	The gated burst signal is applied through T103 to the detector D106. The output of D106 is a positive dc voltage that is proportional to color-burst level.
Balanced Modulator (Frequency Converter)	These components form a balanced modulator which functions as a frequency converter. The 4.34 MHz carrier signal from Q112 is applied

Stage/Control	*Function*
T101, T102, D101, D102, D103, D104	between the center taps of T601 and T602 and the 3.58 MHz modulating signal from Q103 to the primary winding of T601. The output of the modulator contains two sets of sidebands without the carrier. The lower set of sidebands is centered at 767 kHz and the upper sideband frequency is 7.92 MHz. The 3.58 MHz signal is converted into 767 kHz and 7.92 MHz signals. See Fig. 2-13.
R-f Amplifier Q104 ~ Q106	The r-f amplifiers amplify the 767 kHz converted chroma subcarrier. R125 sets the chroma signal level to be recorded on the tape, which is −13.5 dB below the Y-fm level.
Low-Pass Filter L101 ~ L103, C109	The low-pass filter passes the 767 kHz chroma signal and rejects the 7.92 MHz sideband signal.
4.34 MHz Oscillator Q111	This crystal-controlled oscillator generates the 4.34 MHz signal which is used to convert the incoming 3.58 MHz color subcarrier to 767 kHz by heterodyning. Stability of the oscillating frequency is an important factor for tape interchangeability between machines.
4.34 MHz Tuning Amplifier Q112, L105	This stage amplifies the 4.34 MHz signal to the level required to drive the balanced modulator. L105 is tuned to produce maximum output at 4.34 MHz.
REC, E-E↔PB Switcher Q201, Q202, Q210	The transistor switcher selects either the playback chroma or rec, E-E chroma signal to be routed to the playback chroma reproduction circuit. In the playback mode of operation, switcher Q210 is nonconducting so that its collector potential is high, which drives switching transistor Q202 into conduction. The playback chroma signal is present at TP-201 that feeds Q202 and subsequent chroma reproduction circuit. In record and E-E modes, +28 V is supplied to the bases of Q210 and Q201 to drive the two switcher transistors into conduction and Q202 into cut-off. The record mode chroma signal feeds R202, Q201 and the subsequent chroma reproduction circuit.
767 kHz Low-Pass Filter L201 ~ L203, C205	This low-pass filter extracts the 767 kHz converted chroma signal from the reproduced r-f signal including Y-fm carrier.
Chroma Amp Q203	Q203 amplifies the low-pass filter output to the level required to drive the playback automatic color level control circuit Q204.
A.C.C. Q204	This is a fast acting automatic color level control circuit. Q204 operates as a variable resistor connected between Q203 collector and ground. Its resistance is controlled by the d-c signal level being fed to the gate of Q204. The control d-c signal is obtained by rectifying the reproduced burst signal by D205 and D206 in the collector of the burst gate, Q216. The reproduced color signal amplitude is thus held constant despite differences in video head output. This is required to eliminate 60 Hz flicker in the chrominance signal.
Chroma Amp Q205, Q206	This stage amplifies the reproduced chroma signal to the level required to drive the following balanced modulator with sufficient amplitude.
Frequency Converter D201 ~ D204, T201, T202	This balanced-modulator is used as a frequency converter to produce the 3.58 MHz color output signal using the reproduced 767 kHz chroma signal and 4.34 MHz APC loop output carrier signal. The output of the frequency converter is the time-base compensated NTSC color subcarrier signal.
Chroma Output Amp Q208, Q209	This is the chroma output amplifier with good differential gain and differential phase characteristics.
3.58 MHz Oscillator Q211	This crystal-controlled oscillator provides the stable 3.58 MHz signal used to convert the reproduced 767

Stage/Control	*Function*
	kHz converted chroma signal to the 4.34 MHz signal to be used in the APC loop. Stability of the oscillating frequency is important for accurate color reproduction. Q212 and Q213 are buffers. The oscillator output is supplied to two separate frequency converter circuits. Q214 converts the playback 767 kHz chroma signal to 4.34 MHz for use in the APC loop. Q220 in the APC loop converts the time-base-compensated 767 kHz VFO output to 4.34 MHz.
Frequency Converter Q214 and 4.34 MHz Bandpass Filter FL202	This is a conventional mixer where the 3.58 MHz carrier is fed to the emitter of Q214 and the 767 kHz playback chroma signal is injected into the base. The resultant difference frequencies of 4.34 MHz and 2.81 MHz are produced. The bandpass filter FL202 extracts the 4.34 MHz component only and feeds the chroma amp and burst gate circuits.
Chroma Amp Q215	Q215 amplifies the 4.34 MHz converted chroma signal to 7 V(p-p) that drives the subsequent burst gate and the APC loop circuits, such as the phase detector and the voltage-controlled oscillator.
Burst Gate Q216	Q216, gated by Q225, conducts only during the burst portion of the signal. Only the burst signal is amplified and drives the burst detector D205 and D206 in the playback ACC circuit and the phase detector D207 and D208.
Phase Detector D207, D208	The phase detector compares the push-pull feed of separated burst at the secondary of T203 with a sample of the locally-generated 4.34 MHz CW signal at the junction of D207 and D208. The result is a d-c correction voltage whose magnitude is proportional to phase error. This error voltage is filtered by low-pass filter L207 and C248.
Voltage Controlled Oscillator, Q218	A Colpitts type voltage-controlled 767 kHz oscillator is composed of C251, C252, C253, C254, L208 and D209. Frequency control is achieved by a voltage-variable impedance in series with C251. This impedance is the forward resistance of D209 whose d-c operating point is controlled by Q217.
Frequency Converter Q220	The phase-error compensating 767 kHz oscillator output is mixed with the stable 3.58 MHz signal at the emitter of Q220 to produce a beat signal of 4.34 MHz. Q220 is a non-linear amplifier so that only the 4.34 MHz envelope is detected. Diode D213 grounds the positive half cycle and feeds only the negative half cycle to the 4.34 MHz tuning circuit L209 where only the 4.34 MHz signal is developed across L209.
4.34 MHz Tuning Amp Q221	This amplifier is tuned to 4.34 MHz to provide maximum output to the frequency converter and phase detector circuits. Output of Q221 feeds buffer Q222 and another 4.34 MHz amplifier Q207. This 4.34 MHz is the APC loop output signal used for time-base compensation in the chroma reproduction circuit.
Video Amp Q223 and Sync Separator Q225	The reproduced video signal from the demodulator output is amplified by Q223, to the level required to drive sync separator Q225. Q224 is a buffer. Sync is separated from a sample of the video output signal to supply burst keying pulses to the burst gate circuit and, at the same time, vertical blanking signals to the chroma ACC circuit. A sample of the video output is taken from the demodulator output through the COLOR-B/W select switch on the SW3 board. Low-pass filter R307, C267 in the base circuit of Q223

Stage/Control	*Function*
	removes video signals. Q225 is a sync separator providing positive-going composite sync at the collector of Q225. The separated sync feeds a low-Q series-resonant circuit of R317, L212 and C271. The horizontal sync pulses cause the tank circuit to ring for about 1-1/2 cycles; frequency is chosen so that the peak of the first half cycle coincides with burst timing. The signal developed across C271 is the burst keyer.
Vertical Blanking ACC Compensator Q226	The separated sync at the collector of Q225 feeds a two-section integrator R319/C272 and R320/C273. The integrator output drives Q226 into conduction for the vertical blanking interval. Q226 then provides d-c output potential to the playback ACC circuit Q204 during the vertical blanking period so that a d-c output potential replaces the burst rectified ACC control signal from Q216, since the burst signal does not exist during the vertical blanking period. R323 in the emitter of Q226 determines the d-c bias of this amplifier so that the blanking signal is of proper amplitude to maintain a constant ACC level throughout the vertical blanking interval. Unless this stage operates properly, color flicker at the beginning of every vertical field will result.
15,750 Hz Locked Oscillator Q227, Q228	This is the master oscillator for the AFC loop to maintain correct color reproduction in both still and slow playback modes of operation. Q228 emitter output is fed back to the base of Q227 to sustain oscillation. The oscillating frequency is determined by a "twin-T" filter consisting of R327/C279/R328 and C277/R329/C278. Separated sync at the collector of Q225 drives Q227 into cut-off so that the oscillation is locked to the frequency of separated sync signal.
Tuned Amp Q229	The 15,750 Hz oscillator output is amplified by Q229, which is tuned to 15,750 Hz to provide maximum output to the fm discriminator circuit.
F-m Discriminator C285, C286, L213	The f-m discriminator is centered at 15,750 Hz. The network consisting of C286, C287, R345, D216, C289, R346 and R348 passes low frequencies while the network comprising C285, L213, R343, R344, D215, and C288 passes high frequencies. Frequency deviation from 15,750 Hz is detected by these two filters and is developed across C288. The f-m discriminator output feeds the APC loop of the color reproduction circuit.
Comb Filter Circuit Q1501, Q1502 (C3 board)	The comb filter circuit is designed to improve the signal-to-noise ratio of the 3.58 MHz chroma signal 3 dB in playback and record. The reproduced 3.58 MHz chroma signal is supplied to the input circuit from the MC1 board. The input chroma signal is divided into two paths; one is supplied directly to a subtract circuit while the other is supplied to the subtract circuit via a 1H delay line. The subtract circuit consists of R1507 through R1510. The 3.58 MHz chroma signal reverses phase 180° each horizontal period to achieve frequency interleaving. The crosstalk component however maintains the same phase so that only the crosstalk components are removed after the direct chroma signal is subtracted from the 1H-delayed chroma signal. This improves the color signal-to-noise ratio 3 dB. Output of the subtract circuit is amplified and supplied to the MC1 board as the reproduced NTSC composite color signal.
Y-Delay Line DL201 and Low-Pass Filter L214 ~ L217 C291, C292 (MC1 board)	The demodulated Y signal is delayed by DL201 approximately 0.7 μs to compensate for the chroma signal delay. The delayed Y signal feeds a low-pass filter of L214, L215, L216, L217, C291, C292 to remove

Stage/Control	*Function*
	the Y signal in the chroma subcarrier frequency range of 3.58 MHz.
Y + C Mixer and Output Amp Q231, Q232	The Y and chroma signals are mixed at Q231, Q232 supplies the NTSC composite signal to the video out stage in the color mode via the SW3 board. In the monochrome mode, the demodulated Y signal is supplied to the VIDEO OUT connector from the VD1 board via the SW3 board COLOR-B/W select switch.

2-5. SERVO CIRCUIT

Basic principles of the servo and pulse system of the AV-8600 are shown in Fig. 2-14.

The rotational speed and angular position of the heads are controlled by means of a magnetic-brake servo system. In this system the head table is belt-driven at a speed greater than 30 rps by a synchronous motor. The servo system controls a magnetic brake that slows the head table to precisely 30 rps.

Each video head begins to scan the tape about 8 H (horizontal lines) before the vertical sync interval (rf signal) supplied to the video head and ends its scan about 10 H after the next vertical sync interval.

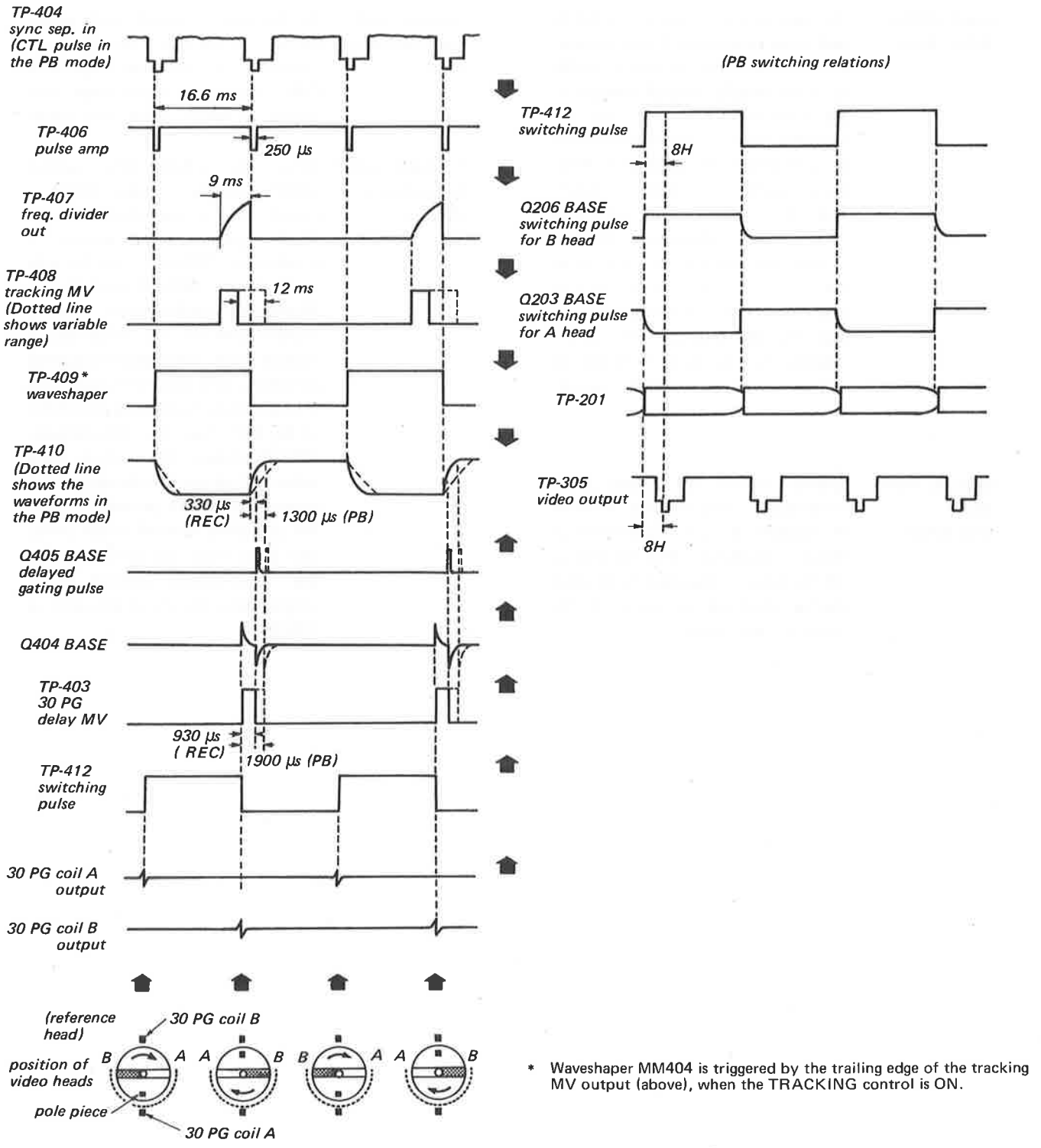
During TV record operations, separated 60 Hz sync signals serve as the timing reference for the servo. The arrival of every other 60 Hz sync pulse is compared with a 30 Hz pulse generated by 30 PG coil B in the Rotary-Head Drum Assembly. See Fig. 2-14. The comparator system of the servo controls brake current to maintain the correct time reference between the sync pulse and the 30 PG pulses.

In playback, the recorded control track pulses serve as the reference for the servo system.

Stage/Control	*Function*
Sync Separator and Pulse Amplifier Q402, Q403	A sample of the composite video signal from Q105 on the VM1 board is fed to Q402. Sync is separated from the composite video signal by Q402, and horizontal sync pulses are removed by the following integrator circuit (R424 through R426, C412 through C414). The separated vertical sync pulse is amplified by Q403 and then triggers monostable multivibrator MM402. During playback, Q401 amplifies control pulses from the recorded tape.
Frequency Divider MM402, R433	A negative sync pulse from Q403, coupled through D404, flips the monostable multivibrator MM402 (hybrid IC) into the unstable state. Pulse duration, determined by R433, is about 24 milliseconds, long enough for the circuit to ignore the next 60 Hz sync pulse. Thus the multivibrator runs at 30 Hz and is triggered by every other pulse. The 60 Hz sync pulse is fed to Pin 2 of MM402, and the divided 30 Hz pulse is obtained at the same Pin 2. Since the sync signal is referenced to the 30 Hz signal from 30 PG coil B, 60 Hz sync pulses must be halved.
Waveshaper MM404, R441	During playback, the output from MM402 is supplied to monostable multivibrator MM404 via SW401-4 and D406, and triggers MM404 (hybrid IC). This multivibrator shapes the 30 Hz pulse from MM402 to form 30 Hz pulses with a 50 % duly cycle so that a reference dc level may be obtaind for the following gate circuit. R441 sets the duty cycle (pulse duration). When the TRACKING control is ON (in playback) the output of MM403 triggers MM404.
Integrator and Gate R446, C426, C427, Q405	The output from MM404 is integrated by R446 and C426 (or C427 in playback) to form the wave-shape shown at TP-410 of Fig. 2-14. The integrated pulse is fed to the gate circuit, Q405. The gate is turned on by the 30 PG pulse (from Q404) applied to its base. For the duration of the 30 PG pulse, the integrated pulse applied to the emitter of Q405 is sampled and appears at the collector, and charges C432. Thus, the output of the gate is a function of the arrival time of the 30 PG pulse. The integrated pulse is gated on its leading edge by

Stage/Control	*Function*
	the 30 PG pulse as shown in TP-410 in Fig. 2-14. If the 30 PG pulse is early (servo too fast) the output of the gate is less. A late 30 PG pulse (servo too slow) results in greater output. During record the integrated 30 Hz pulse rises with a short time constant (R446 x C426) as shown by the solid line in TP-410 in Fig. 2-14. Therefore, a slight deviation of the 30 PG pulse from its stable position on the 30 Hz integrated pulse ramp causes a large variation in gate output for the servo. This results in quick servo response, and also minimizes the variation of control track signals recorded on the tape. In playback, the integrated 30 Hz pulse rises with a faster time constant (R446 x C427) as shown by the dotted line in TP-410 in Fig. 2-14. A deviation of 30 PG pulses (from control track signals on the tape) on the ramp causes less of a variation in the gate output resulting in a slower servo response compared with that in record and absorbs control track signal deviations caused by wow and flutter.
30 PG Coils A and B	Two PG coils are mounted on the scanner (upper drum) 180° apart. 30 PG coil A is at the front of the scanner and 30 PG coil B at the rear. Both PG coils are connected between B+ and ground through R401 and R402 respectively, and biased at about 2 V dc. Their fields are cut once per revolution by a single vane (pole piece) mounted on the rotating head platform. Each 30 PG coil produces a pulse shown in Fig. 2-14.
Switching Pulse Former and 30 PG Pulse Shaper FF401	Negative going pulses of the two 30 PG coils are coupled to bistable multivibrator FF401 (hybrid IC) through D401 and D402. A pulse supplied to Pin 1 flips FF401 and a pulse supplied to Pin 4 flips it back. The outputs from Pins 2 and 3, identical 30 Hz square waves opposite in phase, are applied to switchers Q203 and Q206 through integrators R406/C203 and R407/C206, respectively. A sample of the output from Pin 2 is supplied to a differentiator consisting of R408 and C404. The negative spike from the differentiator, which is in phase with the pulse generated by 30 PG coil B, triggers MM401 to supply the gate circuit.
30 PG Delay Multivibrator MM401, R412, R413	Monostable multivibrator MM401 (hybrid IC) delays the 30 PG pulse (from 30 PG coil B) and sets the timing interval between the vertical sync signal (during record) and the 30 PG pulse from coil B. Since the sync signal serves as the timing reference, the time delay advances the angular position of the rotating-head platform with respect to the video signal. MM401 produces a positive pulse of 930 μs duration during record and on of 1.9 msec duration during playback for each input pulse. This output pulse is differentiated by C428 and R448 and the negative spike, delayed by an amount equal to the pulse duration of MM401, is supplied to the gate circuit. The pulse duration, i.e. the delay time of MM401, is selected by SW401-8 according to the mode of operation. Thus, the differentiated pulse is able to gate the integrated reference 30 Hz pulse at the proper position on the ramp to produce the same gating, output in record or playback regardless of the difference in 30 Hz pulse waveshapes. See Fig. 2-14. R412 and R413 adjust the pulse duration (delay time) of MM401 in record and playback operations respectively.
Delayed 30 PG Pulse Shaper	The delayed 30 PG negative pulse is amplified and shaped by Q404. Output of Q404 feeds the gate circuit.
Dc Holder and Amplifiers C432, Q406,	Gate output appears across C432, which holds the level until the following gate output. C432 sets

Stage/Control	*Function*
Q407, Q408, R451, R454	the gate-to-source voltage of Q406 and thus establishes Q406 output. Direct coupled dc amplifiers Q406 to Q408 supply control current to the servo brake coil. R451 sets the response time of the servo system by controlling the amount of feedback current from Q407 to Q406 and is adjusted for minimum response time without servo hunting. A large amount of feedback reduces the ac gain of the amplifiers and prevents servo hunting but it increases the response time. R454 adjusts the dc gain of Q406 to obtain optimum braking current.
Control Track Head CTL Head	During record, an output from monostable multivibrator MM404 is applied to the Control-Track Head (CTL-Head). This records a 30 Hz timing reference to be used during playback in place of the vertical sync pulse.
Control Track Pulse Amplifier Q401	In playback, control track pulses picked up by the CTL head are amplified by Q401 and coupled to Q402 through a noise filter consisting of R418, C409, and C410.
Tracking Control Multivibrator MM403	When the TRACKING control (R007) on the Control Panel is pulled out during playback, the 30 Hz pulse from MM402 is coupled to MM404 via the tracking multivibrator, MM403 (hybrid IC). Monostable multivibrator MM403 compensates for (a) variations in control track information between recorders, (b) tape stretching, and (c) tolerances in physical placement of the CTL head. For this purpose, MM403 delays the control track pulse and adjusts the timing interval between the video information and the recorded control track pulse. The delay time can be varied with the TRACKING control R007, which varies the pulse duration of MM403.



* Waveshaper MM404 is triggered by the trailing edge of the tracking MV output (above), when the TRACKING control is ON.

Fig. 2-14. Timing relations of pulse and servo system.
(waveforms are not drawn to scale)

2-6. VD FORMER

When the camera is connected and the VTR is set in the camera-record mode, only the VD signal is supplied from the VTR to the camera. The camera's horizontal circuit free-runs without trigger input.

The vertical drive signal is produced in the VTR by sampling the ac power line at the secondary winding of the power transformer. The 60 Hz sine wave is supplied to the SY3 board where the positive half cycle is separated and amplified by Q901. The signal is then differentiated and again amplified by Q902 so that the VD pulse is produced to be supplied to the camera.

2-7. AUDIO CIRCUIT

Refer to Fig. 2-15 for the block diagram.

Record Mode

Audio input is amplified by Q501 and Q502. The preamplifier output is fed to the AGC circuit and the level control R007. The AGC circuit, Q504 and Q505, is controlled by the peak rectified dc level. In the MANUAL mode, the signal level is controlled by R007 and indicates the peak rectified value on the level meter. The output is amplified by the line amplifier Q506 and Q507 so that it is supplied to the audio output connector record amplifier Q510 and buffer Q508. The Q510 output is mixed with the bias signal and then supplied to the audio record head. The bias oscillator Q513 oscillates at 100 kHz for record bias and erase signal.

Playback Mode

The playback signal is amplified by the equalizer amplifier Q501 and Q502 and then by the subsequent line amplifier before it is supplied to the output connector.

2-8. POWER SUPPLY

A full-wave rectifier and voltage regulator circuit are connected in the secondary winding of the power transformer. 28 V dc is the regulated output voltage. There is another regulator circuit to supply 10 V dc from the 28 V dc for the rf adaptor.

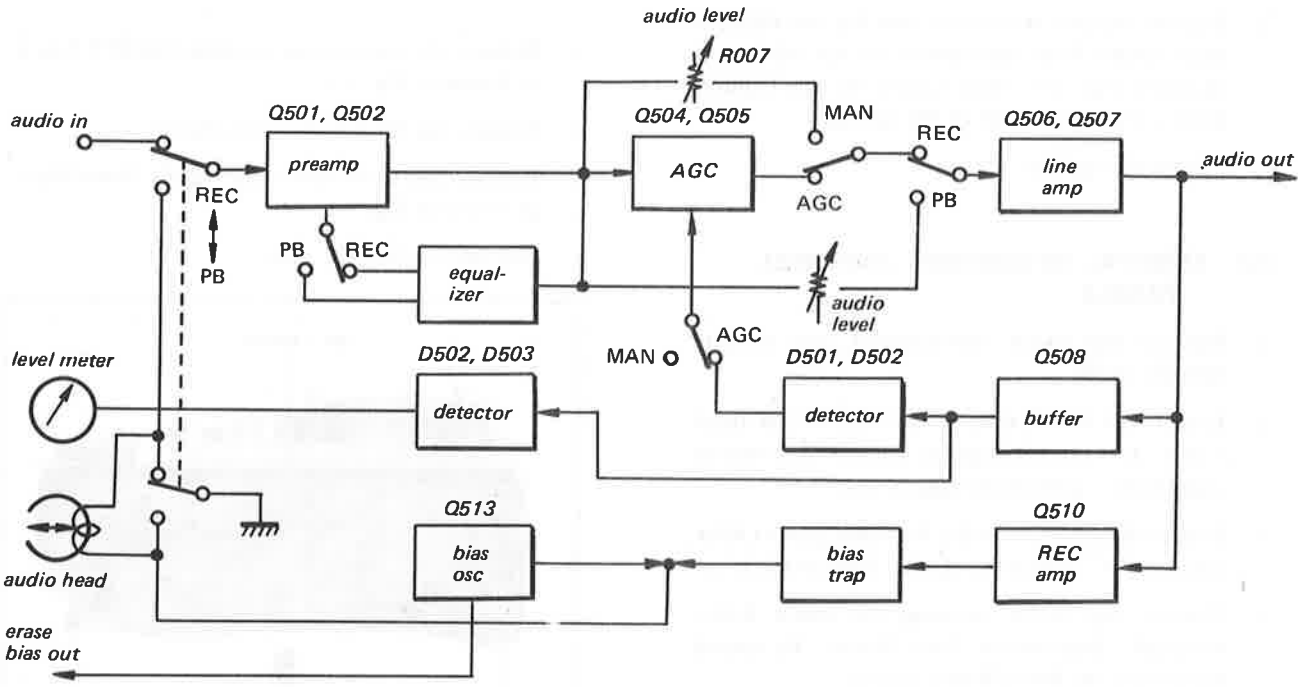


Fig. 2-15. Audio circuit block diagram

SECTION 3
DISASSEMBLY

3-1. CABINET REMOVAL

1. Turn the VTR (with cabinet lid) upside down on a padded bench as shown in Fig. 3-1.

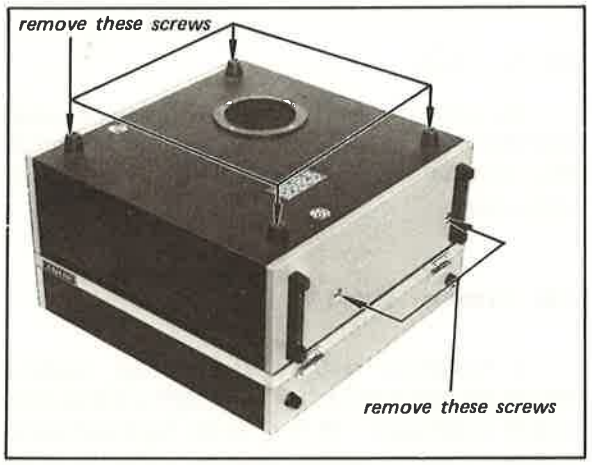


Fig. 3-1. Cabinet removal

2. Remove the two rubber feet and the two Phillips-head screws from the bottom of the cabinet as shown in Fig. 3-1. Also remove the two Phillips-head screws on the side of the cabinet.
3. Lift off the cabinet.

3-2. REMOVAL OF CONTROL AND REEL PANELS

1. Pull off the SKEW, TRACKING, and AUDIO LEVEL knobs.
2. Loosen the two screws at the back of the Head Cover. It is not necessary to remove these screws completely. Lift off the Head Cover.
3. Loosen the set screw in the Function Lever (Allen wrench, 0.1" across the flats). Pull off the lever.
4. Remove the screw securing the Pinch Roller Retainer. Remove the Pinch Roller. Be careful not to lose the Pinch Roller Spacer.
5. Loosen the two screws "A"* and remove the four screws "B" as shown in Fig. 3-2.
6. Lift off the Reel Panel.
7. Remove the two screws "C" as shown in Fig. 3-2.
8. Lift off the Control Panel.

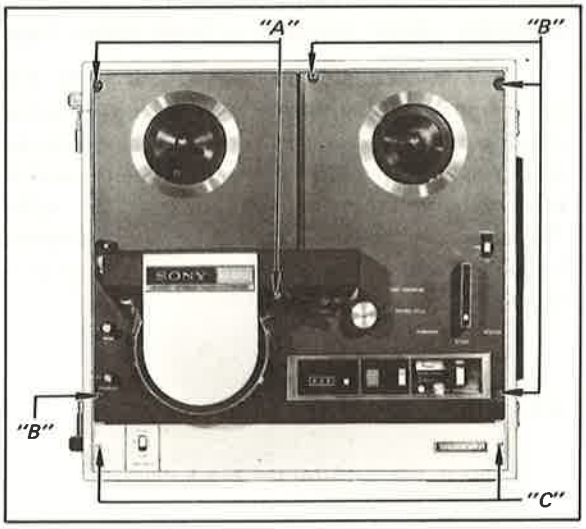


Fig. 3-2. Removal of control and reel panels

3-3. MC1 PRINTED CIRCUIT BOARD AND SHIELD PLATE REMOVAL

1. Remove the two screws securing the MC1 board, as shown in Fig. 3-3.
2. Remove the MC1 board from the set.
3. Remove the two screws securing the Shield Plate, as shown in Fig. 3-4.
4. Remove the Shield Cover.

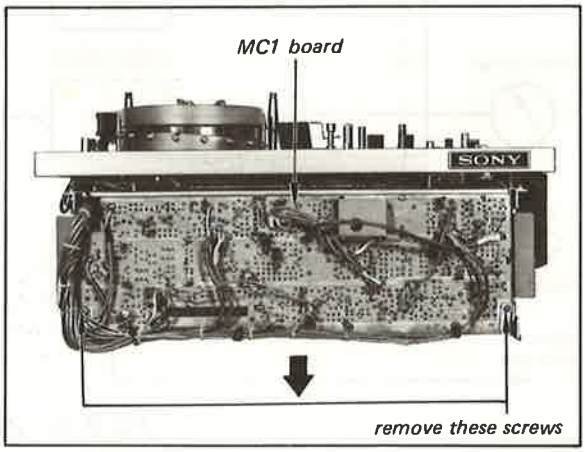


Fig. 3-3. MC1 board removal

*These are captive screws and need not be removed completely.

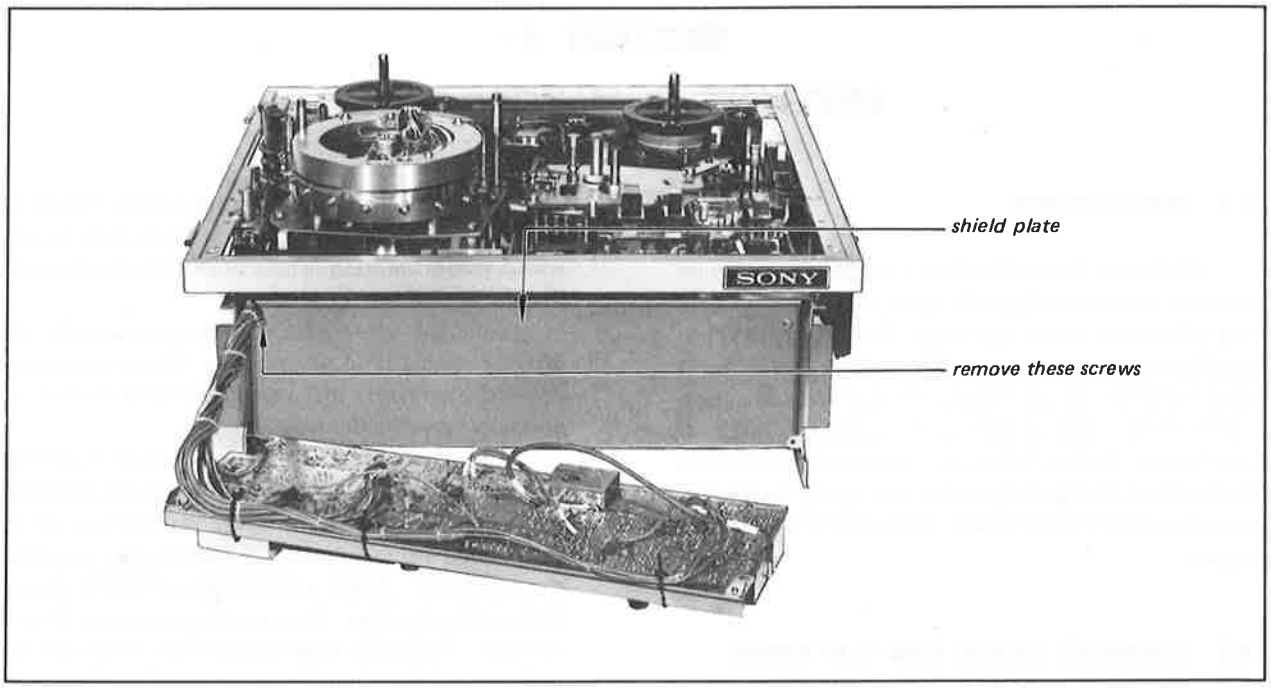


Fig. 3-4. Shield plate removal

SECTION 4
MECHANICAL MAINTENANCE

4-1. PRECAUTIONS

Machine compatibility (interchangeability of tapes between machines) depends upon very close mechanical tolerances in the tape path. The tape path is factory-adjusted and should not require realignment under normal circumstances. Do not attempt adjustment of the tape guides or the tapered guides. If mechanical damage requires replacement and/or adjustment of the guides in the tape path, return the unit to a SONY FACTORY SERVICE CENTER for repair.

4-2. CLEANING HEADS AND SLIP RINGS

Noise in the picture during playback is usually caused by an accumulation of debris in the video heads. In some cases, half the picture may be noisy (split screen); in severe cases, video output may be lost.

To clean the heads, stop the machine, remove the tape and move one of the heads to the cleaning position near the left tapered guide. See Fig. 4-1.

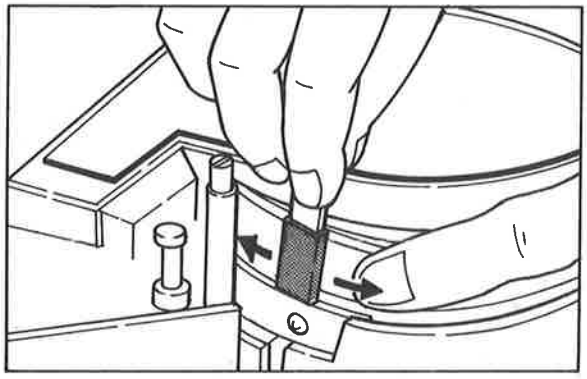


Fig. 4-1. Video head placed at the cleaning position

CAUTION

NEVER TRY TO CLEAN THE HEADS WITH THE MOTOR RUNNING

Saturate a cleaning tip with SONY cleaning fluid or methanol. (Spray cleaner, such as M/S brand magnetic head cleaner, gives excellent results.) Rub the cleaning tip across the head tip from side to side. Avoid vertical motion, which might damage the video head.

Clean the erase and audio/control heads with SONY cleaning fluid, if necessary. Move the cleaning tip vertically across that part of the head surface that normally contacts the tape.

Noisy slip rings cause intermittent dark horizontal lines in the playback picture. To clean the slip rings, remove the upper drum cover on the top of the rotary-head drum assembly. Remove the tape from the tape path. Apply a few drops of SONY cleaning fluid to the slip rings. Turn on the motor for 10 to 20 seconds. Carefully wipe excess fluid from the tape path around the rotary head drum assembly.

If slip-ring noise persists, clean the slip rings directly with a head-cleaning tip saturated with SONY cleaning fluid. Rotate the head assembly by hand to avoid contacting the brushes.

4-3. LUBRICATION

Five major lubrication points are:

1. Supply-Reel Table Spindle.
2. Take-Up Reel Table Spindle.
3. Capstan Bearing.
4. Take-Up Reel Idler Bearing.
5. Pinch Roller Bearing.

To lubricate the reel table Spindle, remove the screw and washer at the top of the spindle. Lift the reel table slightly so that the hollow shaft of the table rises above the spindle. Apply one or two drops of SONY oil, OL-1K, to the inner surface of the reel table Spindle. Seat the reel table in its proper position and replace the screw and washers.

To lubricate the Capstan Bearing, remove the Capstan bearing cap and apply a few drops of oil to the Oil Ring of the Capstan Bearing. See Fig. 4-2. To lubricate the Pinch Roller Bearing, remove the Pinch Roller Retainer. Apply a drop of oil to the oil ring of the Pinch Roller. Be careful not to get oil on the surface of the Pinch Roller. Wipe off excess oil.

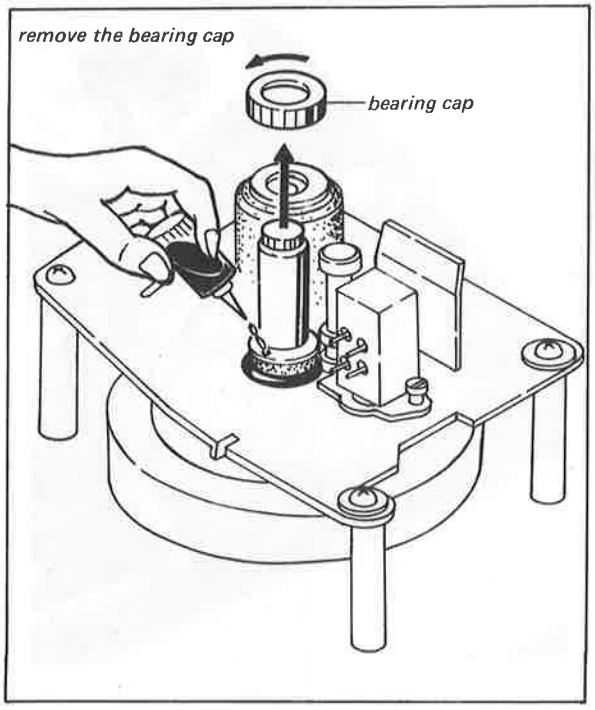


Fig. 4-2. Lubrication of capstan bearing

To lubricate the Take-Up Reel Idler, remove the Take-Up Idler Cap. Apply a drop of oil to the shaft of the idler. Wipe away excess oil from the rubber driving surfaces.

> **Note:** A lack of oil on this part sometimes causes bearing noise in Play and Fast-Forward modes.

Sliding Parts. All sliding parts of the tape-transport mechanism are lubricated with grease which, in normal use, need not be replenished. However, if new parts are installed or lubrication is obviously needed, apply a high-temperature grease at points of contact. Avoid excessive lubrication.

4-4. DRIVE-BELT REPLACEMENT

A worn or stretched drum drive belt results in excessive slippage and loss of servo control.

Check the belt by inspecting the inner (bearing) surface. Look for cracks and streaks along the long dimension of the belt. Replace the belt if it is badly scored along its length. To check belt length, remove the belt from the machine and compare its total length (flattened) with that of a new belt from stock. Replace the belt if it is ¼-inch or more longer than a new belt.

To install the head-drum belt, stand the VTR on its left side. Loop the belt over the motor pulley, with the shiny side of the belt inside (against the pulley). Grasp the bottom of the loop, turn it one-half turn clockwise, and wrap around the pulley of the rotary head drum assembly.

Insert the belt separator between the two belts in the center of belt crossing point. Adjust the convex part on the Discharge Band Cam to slightly contact the Belt See Fig. 4-3.

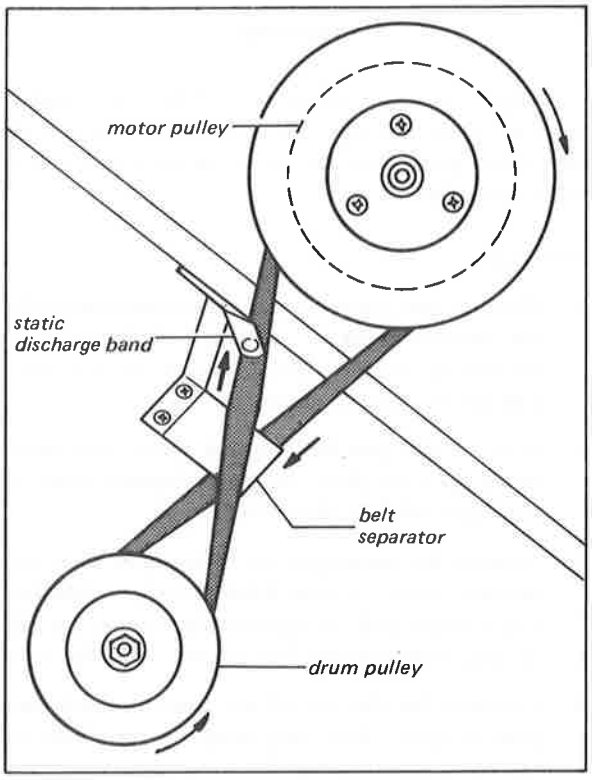


Fig. 4-3. Drive belt installation

4-5. DRIVE PULLEY ADJUSTMENT

The lower motor pulley requires adjustment if the head-drum drive belt slips off the pulley or rides against the upper or lower shoulder of the pulley. Adjust the pulley as follows. Remove the drive belt. Loosen the set screw on the motor pulley and adjust its height by eye until it is parallel to the pulley on the rotary-head drum assembly. Reinstall the belt. (See Section 4-4). Place the VTR in the normal horizontal position. Thread and play the tape. Observe the position of the belt on the pulleys. Stop the machine and readjust pulley position to make the belt run in the center of the pulleys.

Check final pulley position by starting and stopping the tape several times. Rewind the tape and try the fast-forward mode a few times. Make sure that the belt does not drift towards the edge of the pulley or slip off when changing speeds.

4-6. VIDEO HEAD REPLACEMENT

Video Head replacement is required when the heads are damaged or have open coils. In addition, insufficient tape penetration, resulting from head wear after long periods of operation may necessitate replacement. To remove and replace the rotary head assembly (the beam on which the two video heads and the slip-rings are mounted), proceed as follows.

CAUTION

The video head assembly and the surrounding machined parts are very precisely made. Use utmost care when performing any work on the rotary head-drum assembly.

Removal

1. Turn off the power. Loosen the screws that hold the head-drum cover. Loosen only half a turn; do not try to back the screws all the way out. Lift off the head-drum cover.
2. Remove the two Phillips-head screws that hold down the cover plate. Scribe a reference mark on the upper drum as shown in Fig. 4-4.
3. Remove the two upper 5 x 20 hex-head bolts and washers with a 4 mm Allen wrench. Hold the upper drum with one hand so that it does not fall as you withdraw the two screws. See Fig. 4-4.
4. Carefully lift the top of the drum assembly and fold it back. Place the drum top carefully on the reel panel. See Fig. 4-5.

Fig. 4-4. Upper drum removal

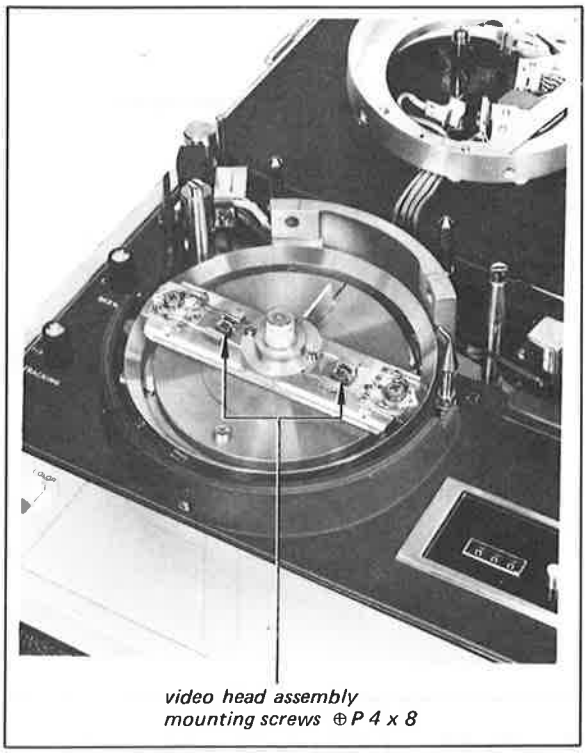


Fig. 4-5. Video head assembly removal

CAUTION

Do not touch the PG pole pieces.

Position the rotary head platform by turning the aluminum beam on which the heads are mounted. Slight pressure on the pole pieces can affect pole piece alignment.

5. Hold the Video Head Assembly to keep the platform from rotating and loosen the two P 4 x 8 screws that hold the head assembly to the platform. Do not exert too much downward pressure on these screws; loosen the locking compound with Methyl Ethyl Ketone. Remove the screws and the washers.
6. Using both hands, carefully lift the Video Head Assembly off the platform.

Replacement

7. Clean the bottom of the new Video Head Assembly. Do not scratch or remove the spacer on the bottom of the Video Head Assembly.
8. Position the platform so that the 30 PG pole piece is at the 12 o'clock position.
9. Carefully place the Video Head Assembly on the platform with the B head (identified by the red paint) to your left (9 o'clock position). See

Fig. 4-6. The head assembly should fit down snugly against the platform without using force.

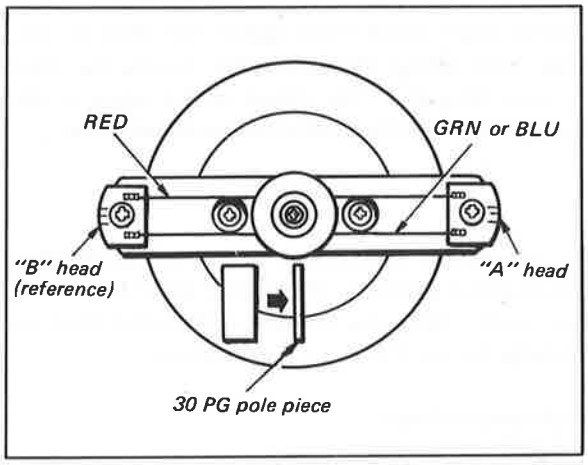


Fig. 4-6. Position of the head assembly

10. Install the two P 4 x 8 screws and washers. Rotate the head assembly gently to the left and right until it is approximately in the center of the angular "play" permitted by the mounting screws. Tighten the screws alternately, applying torque gradually until the screws are tight.

11. Carefully swing the top of the Rotary Head Drum Assembly back into place, support the top with one hand while inserting the two hex-head bolts and washers. Do not tighten the screws all the way.

12. Grasp the top of the Rotary Head Drum Assembly and push it back and down against the drum holder so that top surface of the upper drum is even with that of the drum holder.

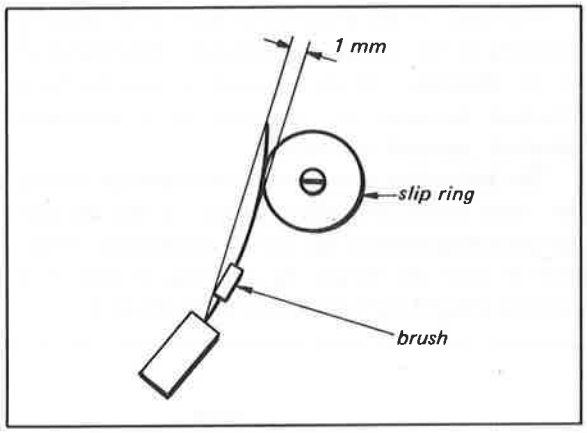


Fig. 4-7a. Brush pressure adjustment

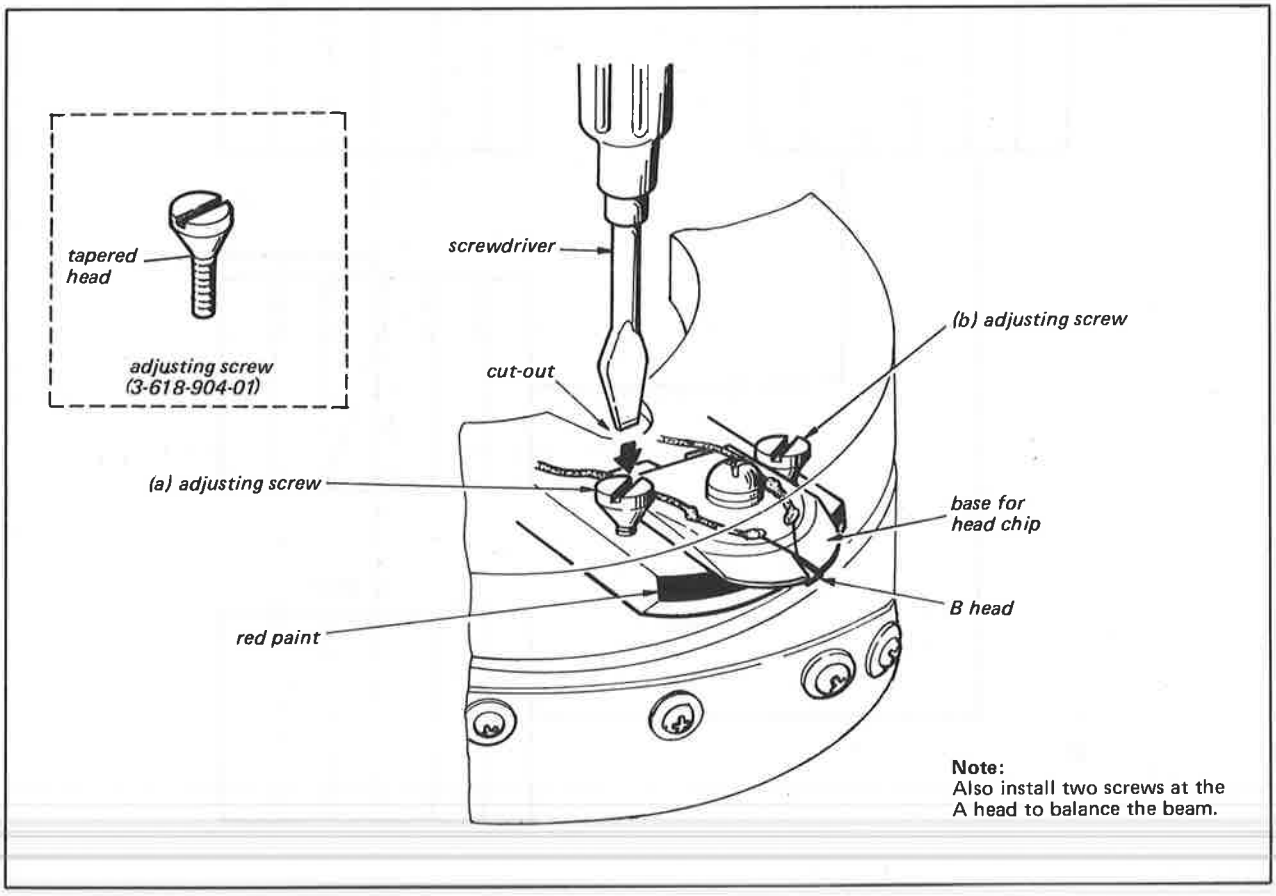


Fig. 4-7b. Video head dihedral adjustment

13. Tighten the two bolts alternately, applying torque gradually until all are tight.

14. Tighten the brush pressure adjusting screws to obtain a 1 mm bend (approximately) as shown in Fig. 4-7a. Inspect the brush and slip-ring assembly to make sure that the brushes are centered in the slip-rings.

Video Head Dihedral Adjustment

Normally, if the video heads have been replaced according to the foregoing procedure, dihedral need not be adjusted. If the dihedral setting has been disturbed, however, or readjustment is otherwise indicated, proceed as follows.

The two video heads should be displaced exactly 180° apart measured at the head gap. If they are not, tape interchangeability can not be maintained. Video Head B (*not* A) should be adjusted so that it is correctly aligned with respect to Video Head A.

This adjustment requires the use of the SONY Alignment Tape and the four adjusting screws shown in Fig. 4-7b. The adjusting screw has a tapered head which bears against the base of the head when turned clockwise, thus forcing the head to move laterally. The thread of this screw is different from that of any other conventional screw.

CAUTION

Do not use conventional screws for the dihedral adjustment as damage to the threads in the head beam will result. Adjusting screws for the video head are available for all AV-Series Videocorders.

Proceed as follows:

1. Thread a SONY Alignment Tape onto the Videocorder.

2. Play back the tape with a monitor connected.

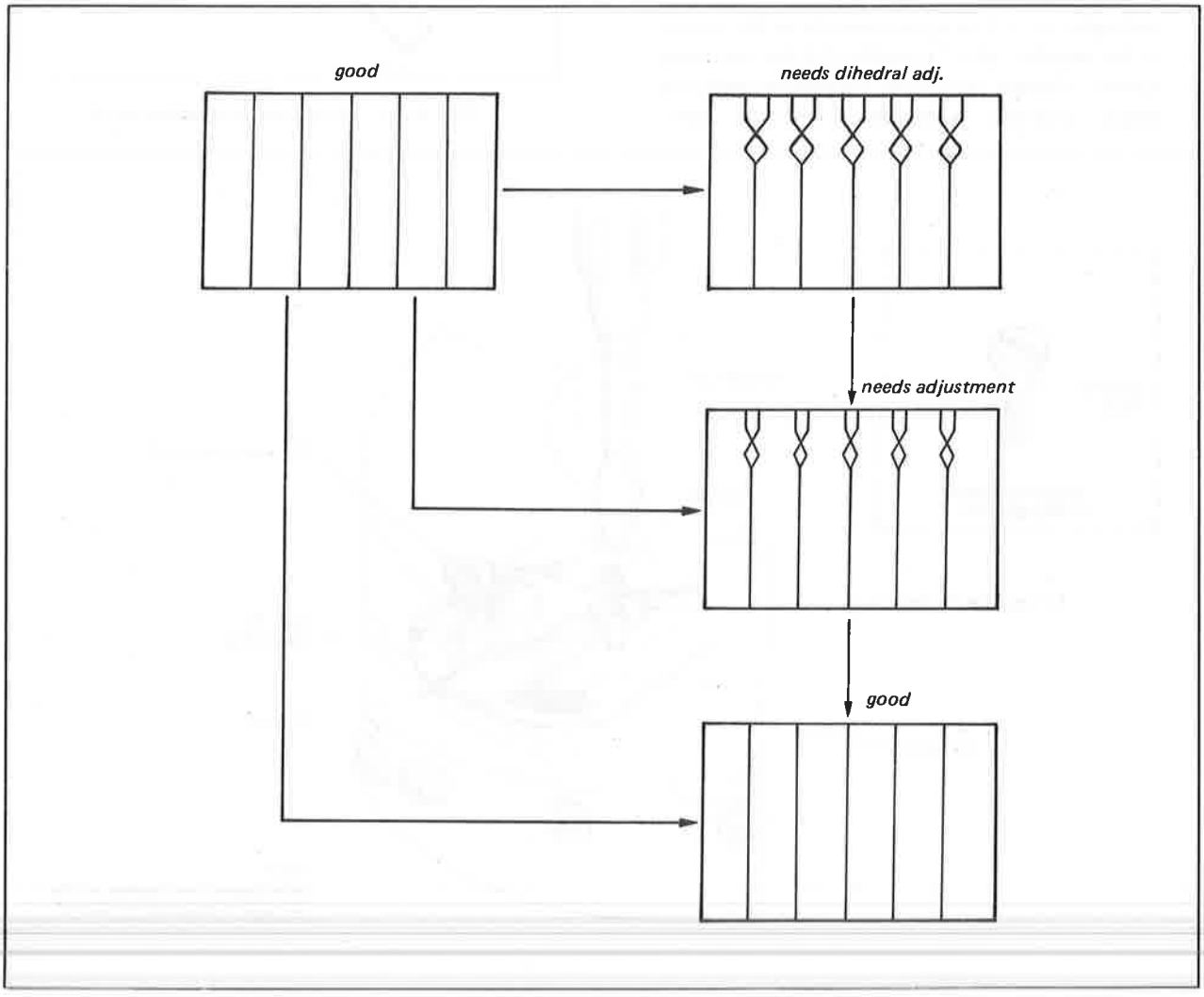


Fig. 4-7c. Picture detail for dihedral adjustment

3. Observe the picture on the monitor. (DO NOT USE A MONITOR SET FOR A SHORT HORIZONTAL AFC TIME CONSTANT.)
   If the top of the picture is as shown by "A" in Fig. 4-7c (it appears as horizontal jitter), adjust Video Head B as follows.
4. Stop the Videocorder and remove the tape.
5. Position the B head so that the threaded adjusting-screw holes are accessible through the cut-out in the upper head drum. See Fig. 4-7b.
6. Install the adjusting screws into the threaded holes at either side of the head base until the tapered part just touches the head base.
7. Similarly, install adjusting screws into the two threaded holes at either side of the A head. These two screws serve only as weights to counterbalance the head-mounting beam.
8. Play back the tape and observe the top of the picture shown at "A" in Fig. 4-7c.
9. Stop the Videocorder. Position Video Head B (identified by red paint on the outer edge of the beam) to the adjusting position shown in Step 5.
10. First, loosen the (a) adjusting screw about a quarter turn counterclockwise and tighten the (b) adjusting screw a quarter turn clockwise. See Fig. 4-7b.
11. Play back the tape. Check the picture on the monitor screen.
12. If the dihedral error does not change, repeat Steps 9, 10, and 11 until a change is visible.
13. If the dihedral error decreases, repeat Steps 9, 10, and 11 until a normal picture is obtained.
14. If the dihedral error increases, reverse the direction of rotation of the adjusting screws and repeat Steps 9 to 12 until the distortion in the picture is minimized.
15. Remove the four adjusting screws from the head assembly.

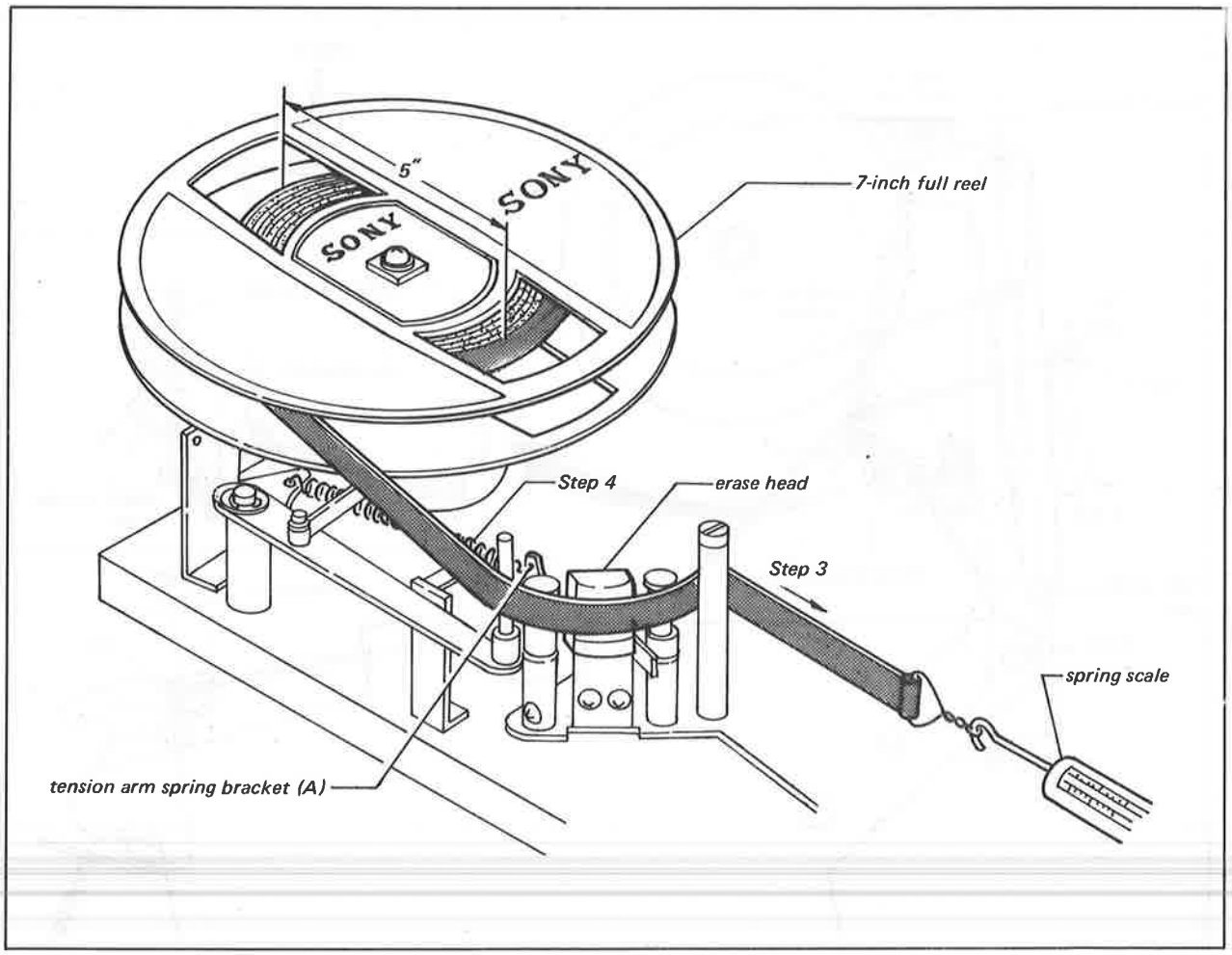


Fig. 4-8. Tape tension check

4-7. TAPE TENSION BRAKE CHECK

This adjustment corrects the back tension applied by the Tension-Brake Servo to the Supply Reel.

1. Place a reel with 5 inches (diameter) of tape on the Supply-Reel Table. Set the Function Lever to the FORWARD position. Set the SKEW Lever in the middle position.
2. Make a loop in the tape and attach a spring scale as shown in Fig. 4-8.
3. Pull the scale in the direction indicated – a steady pull at approximately the correct tape speed should give a reading of 40 to 45 grams.
4. If not, remove the Reel Panel and adjust the position of spring bracket (A) to obtain a correct reading. See Fig. 4-9.
5. Repeat the tension check using a supply reel with a few turns of tape on it. It should yield a reading of 65 grams or less. If it does not, proceed to Steps 6 through 10 and then repeat Steps 1 to 3.
6. Set the Function Lever to the FORWARD position.
7. Check the distance between the Tape Guide Pin on the Tension Arm and the extreme left edge of the drum deck as shown in Fig. 4-9. It should be about 1 mm. Swing the Brake Band as needed to obtain the correct spacing.
8. Check for clearance between the hole in the chassis and Item ① shown in Fig. 4-9. If the correct clearance cannot be obtained, bend Part A with a pair of pliers to obtain the gap. (Don't bend it too much.)
9. Check the distance between the rod and the Tension Arm as shown in Fig. 4-9. It should be 2 mm. Bend the end of rod as needed to obtain the correct spacing.
10. Set the Function Lever to the STOP position. Check the position of the Tape Guide Pin shown in Fig. 4-9. Reposition the Tension Arm Stopper to obtain the correct position.

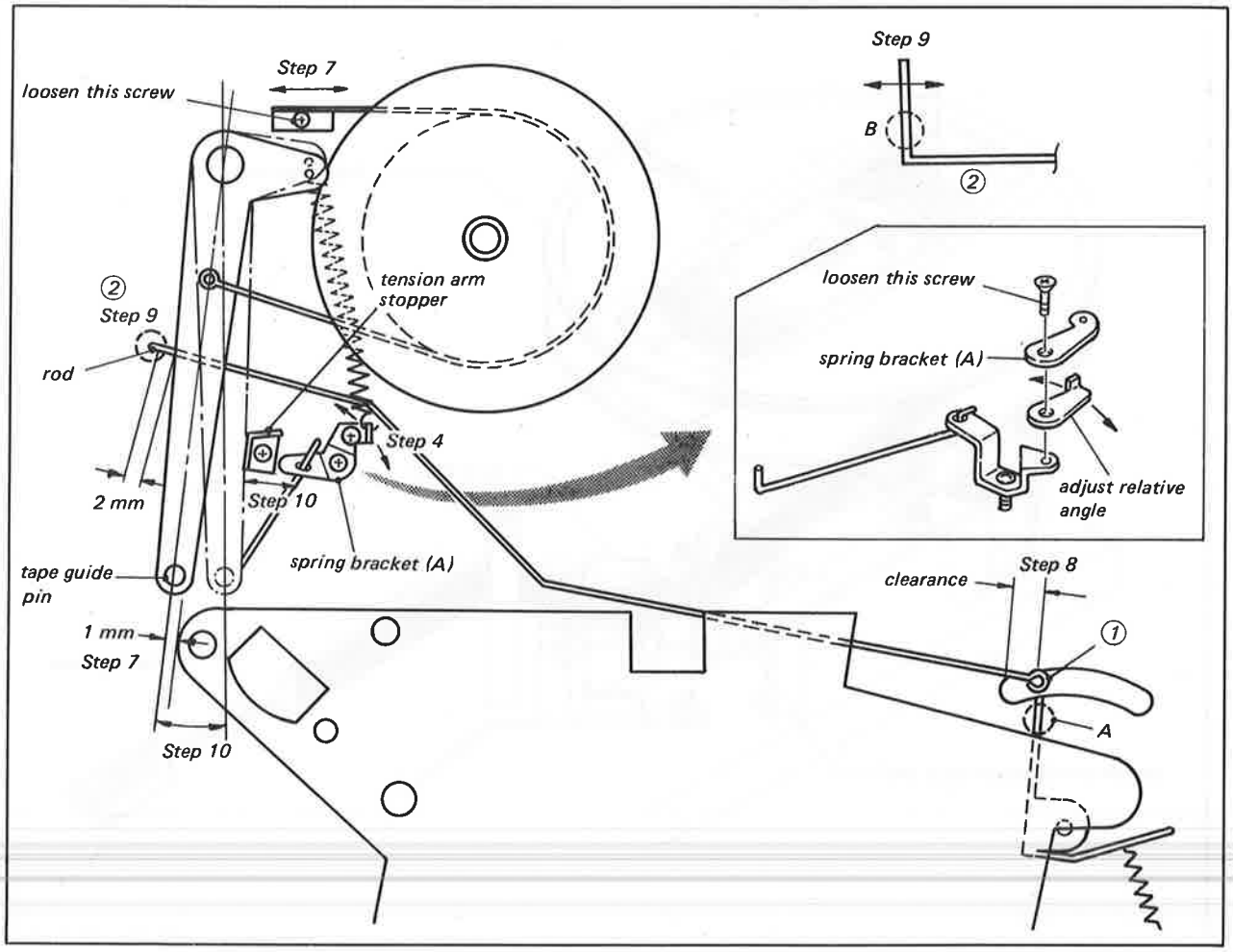


Fig. 4-9. Tension arm adjustment

4-8. REEL TABLE HEIGHT

1. Run a tape in the FORWARD mode.
2. Check both reels to see that tape does not rub against the edges of the reels.
3. If the tape is not centered in either reel, adjust reel height by adding or removing the fiber washers (Thrust Bearing Washers, Part Number 3-005-074-51, 52, 53) beneath the Reel-Table Assembly.

4-9. AUDIO/CONTROL HEAD REPLACEMENT

A malfunctioning Audio/Control Head can be replaced without disturbing servo tracking by the following procedure.

1. Unsolder the leads at the rear of the Audio/Control Head.
2. Remove the screws labelled A and C in Fig. 4-10 (a). Be careful not to lose the spring on the left screw (A). Do not loosen the screws in the long slots.
3. Lift the head assembly off the mounting plate.
4. Remove the screws labelled B and D in Fig. 4-10 (a) and install the screws on the new head assembly.
5. Install the Head Mounting Plate Assembly using the original screws A and C in Fig. 4-10(a). The spring on screw A goes between the head of the screw and the top of the mounting plate. Tighten screw A and adjust screws B, C and D as follows.
6. Play the tape and check that the core of the head extends an equal amount above and below the edges of the tape. See Fig. 4-10(b). Adjust the height and tilt screws at the front and rear of the mounting assembly, if necessary, until this condition is achieved.
7. Thread the SONY Alignment Tape and play the 7 kHz section. Connect an AC VTVM to the LINE OUT connector on the Connector Panel and terminate this connector with a 10 kΩ resistor, Adjust the azimuth and tilt screws (Screws B and D in Fig. 4-10(a)) for maximum indication on the VTVM (maximum output at 7 kHz).
8. Check audio bias voltage. See Section 8-6.

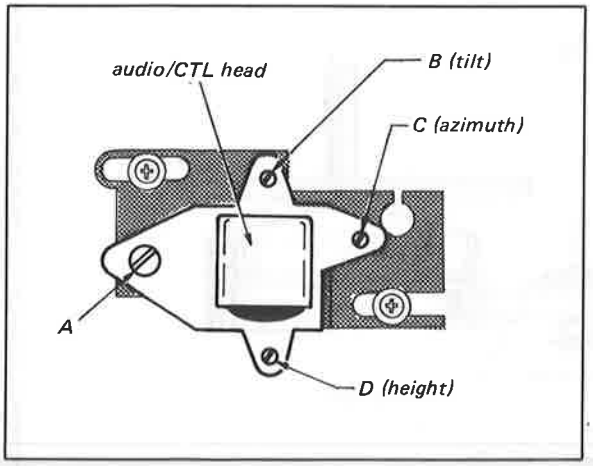
4-10. TAKE-UP IDLER ADJUSTMENT

Capstan Motor Pulley Height Check

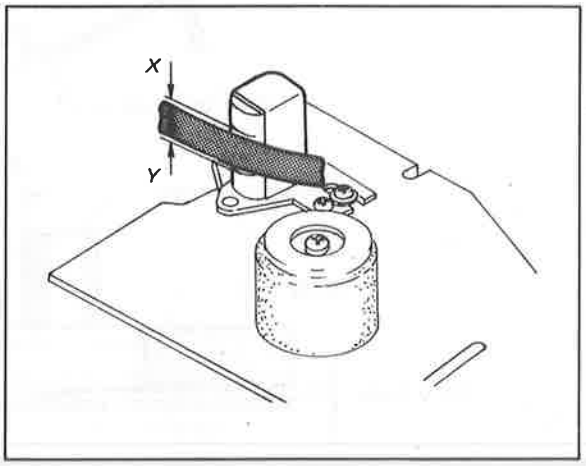
1. Make sure the Capstan Belt is clear of the Pause Brake Push Rod by 0.5 to 1 mm. See Fig. 4-11.
2. Check that the Capstan Motor Pulley is clear of the Take-Up Idler by more than 1 mm. See Fig. 4-11.
3. Adjust the height of the Capstan Motor Pulley, if necessary.

Take-Up Idler Height (Fast Forward Mode)

1. Set the Function Lever to the FAST FORWARD position. The Take-Up Idler is lifted by the Take-Up Cam. Make sure that the lower surfaces of the



(a)



(b)

Fig. 4-10. Audio/Control head replacement and adjustment

Take-Up Idler and the Take-Up Reel Table (upper) are in line or that the lower surface of the Take-Up Idler is slightly higher.

2. If this condition does not exist, place the Function Lever in the FORWARD position. Bend Finger A with a pair of pliers as shown in Fig. 4-12. to obtain the correct Take-Up Idler height.

4-11. REWIND IDLER REPLACEMENT

1. Check the Rewind Idlers if the machine is noisy or does not wind up tape smoothly and rapidly during rewind, or if the Supply Reel is not braked properly when going from FORWARD to STOP.
2. Inspect the driving surfaces of both Rewind Idlers for excessive or uneven wear. Inspect the driving surface of the Supply Reel Assembly. Clean away any oil or debris from all driving surfaces.
3. Set the Function Lever to STOP. Check that the Right Rewind Idler is clear of the Idler Stopper by 0.5 to 1 mm. See Fig. 4-13. If this condition does not exist, bend the Idler Stopper with a pair of pliers.
4. Check that the contacting surfaces of the Right and Left Rewind Idlers are parallel. If they are not, bend them by hand.
5. Set the Function Lever to STOP. Check that the Supply Reel Table, Left Rewind Idler, and Right Rewind Idler are contacting securely. Make sure at this time that the Right Rewind Idler is disengaged from the Take-Up Reel Table by more than 1 mm. See Fig. 4-13. To replace the Rewind Idlers proceed as follows.
6. Set the Function Lever to FORWARD. Pry the Retaining Ring (E5) from the top of the Left Rewind Idler shaft using a screwdriver. Remove the fiber washer. Lift the Left Rewind Idler off its shaft.

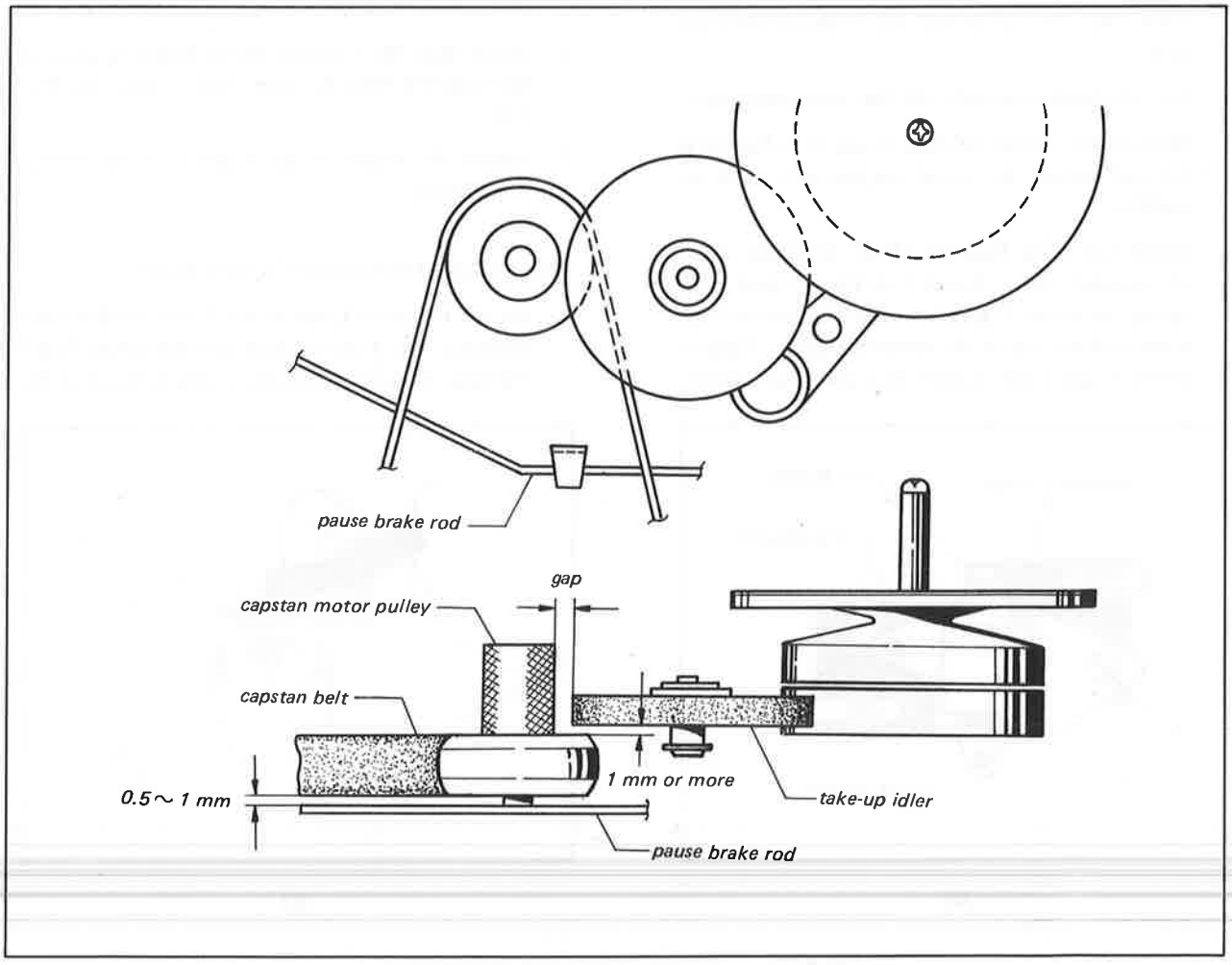


Fig. 4-11. Capstan motor pulley height

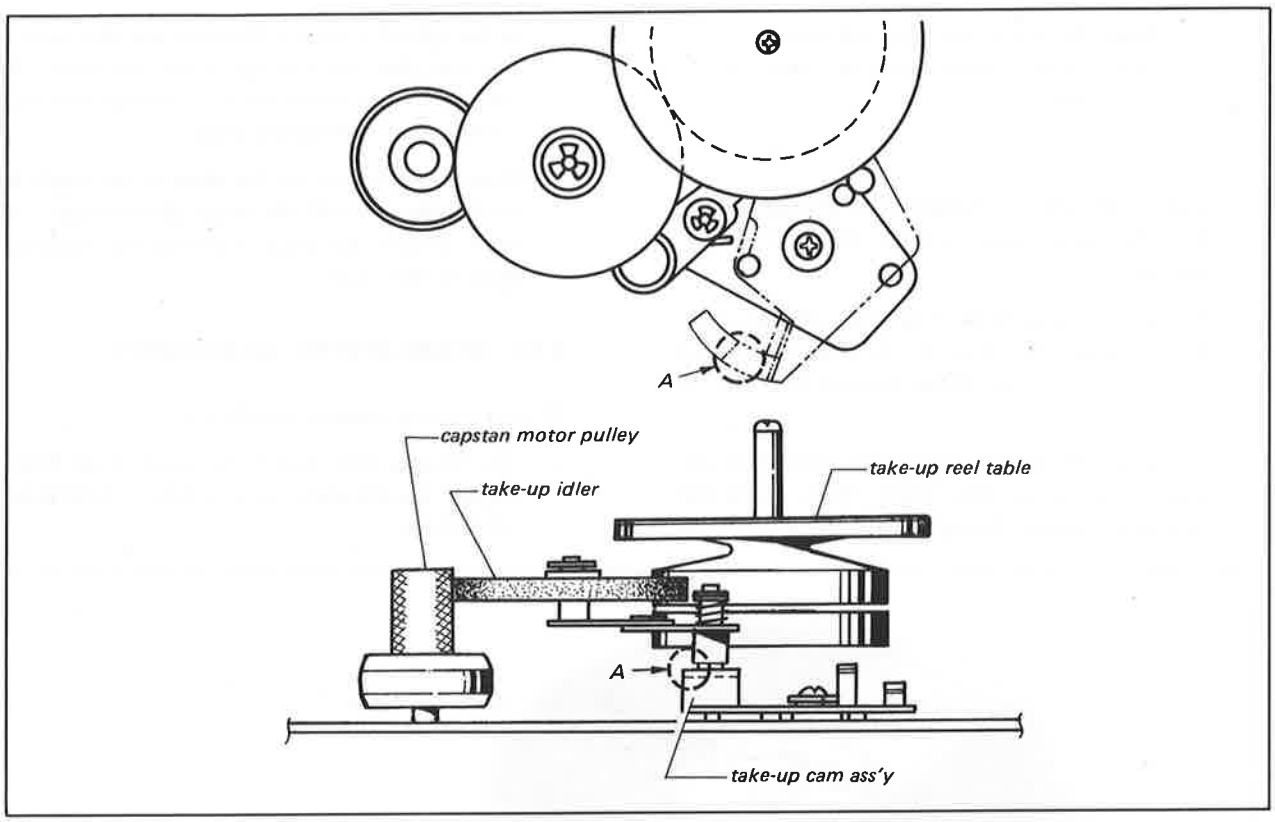


Fig. 4-12. Take-up idler height

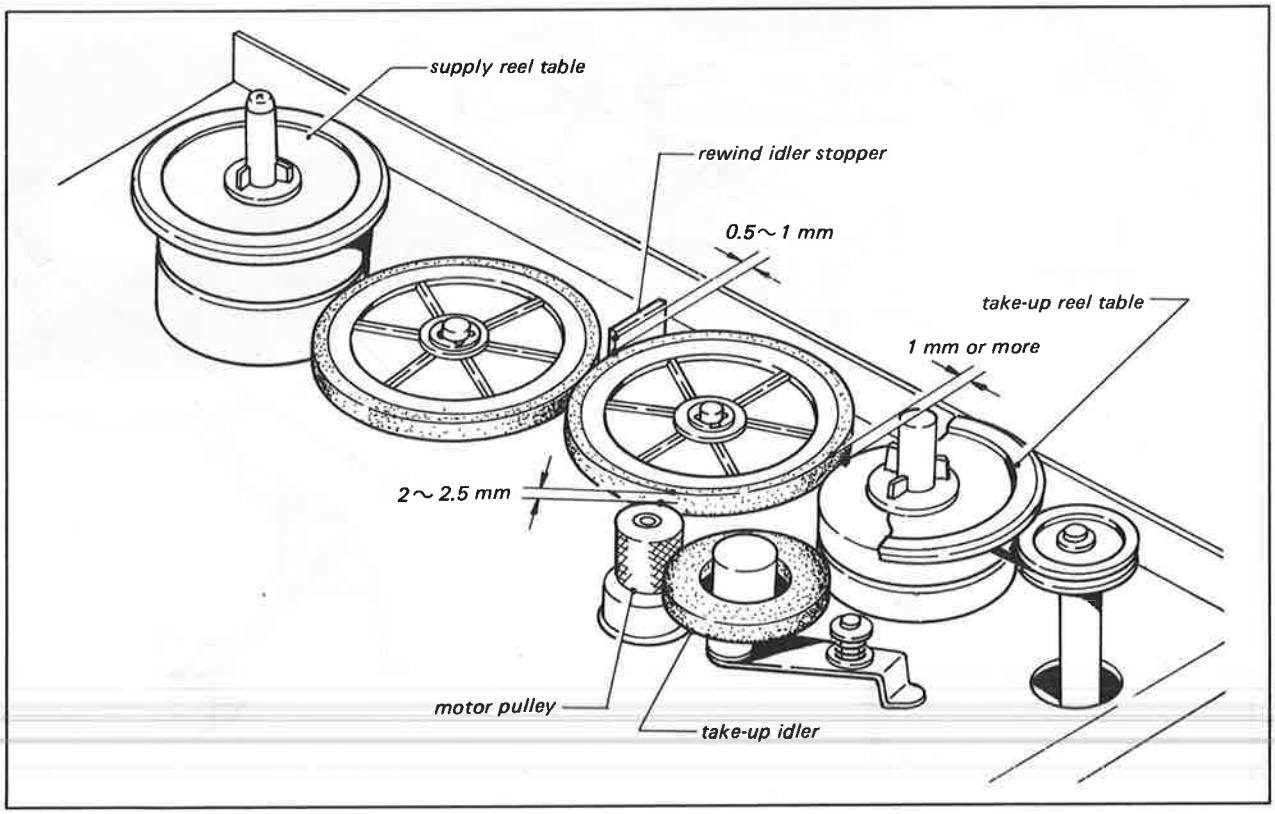


Fig. 4-13. Rewind idler replacement

Note: The directional brake will spring back counterclockwise when the idler is removed.

7. Inspect the idler to identify top and bottom so that the replacement will be installed correct side up.

8. Pry the Retaining Ring (E5) from the top of the Right Rewind Idler. Remove the fiber washer and push rod. Lift the Right Rewind Idler off its shaft.

9. To replace the Left Rewind Idler, first place one drop of oil on the idler shaft. Next, rotate the directional brake clockwise until the point faces to the right (3 o'clock). Position the idler shaft so that the idler can be dropped onto the shaft. Release the directional brake. Install the fiber washer and the Retaining Ring.

10. Place a drop of oil on the shaft of the Right Rewind Idler. Install the Right Rewind Idler, the fiber washer, the push rod, and the Retaining Ring in that order.

4-12. BRAKE-SYSTEM ADJUSTMENT

System braking requires attention if:

a. The Supply Reel exerts too much back tension during FORWARD and FAST FORWARD operations.

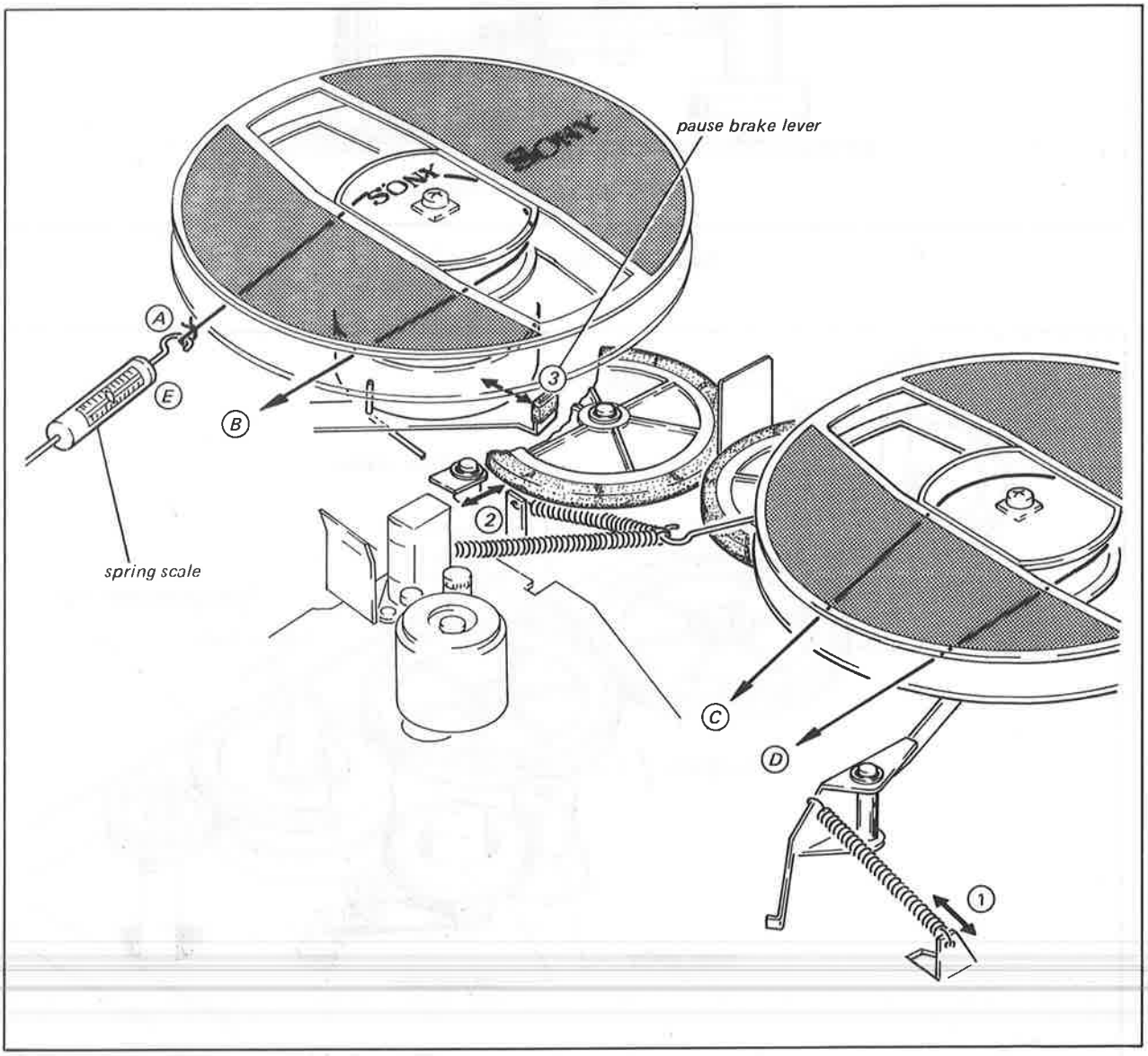


Fig. 4-14. Brake torque adjustment

b. The Supply Reel pays out and slackens tape when going from FORWARD or FAST FORWARD to STOP.

c. The Take-Up Reel exerts too much back tension during Rewind.

d. The Take-Up Reel pays out too much tape when going from REWIND to STOP.

e. The Supply Reel rotates during Pause operation.

Brake Torque Adjustment

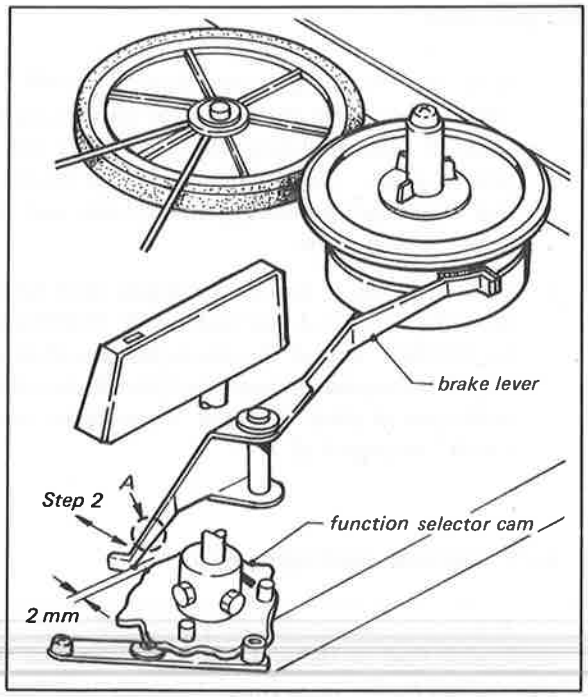
1. Set the Function Lever to STOP.
2. Place an empty reel (RH-7V) with several turns of string wrapped around the hub onto the Supply Reel Table as shown in Fig. 4-14. Tie the reel to the spring scale. Pull the scale at a speed of approximately 4 inches/sec. Check the reading for brake torque. It should be more than 800 g-cm.
3. Repeat the above brake-torque checks for Ⓑ, Ⓒ and Ⓓ as indicated in Fig. 4-14. The brake torques should be less than 400 g-cm for the direction of Ⓑ, less than 450 g-cm for the direction of Ⓒ and more than 800 g-cm for the direction of Ⓓ.
4. Bend Spring Supporting Brackets ① and ② with a pair of pliers, if necessary, to obtain the correct brake torques.
5. Set the Function Lever to PAUSE.
6. Repeat the procedure described in Step 2 for the direction indicated by Ⓔ in Fig. 4-14. It should be more than 1,000 g-cm.
7. If necessary, bend the portion of the Pause Brake Lever identified by ③ with a pair of pliers.

Take-Up Brake Lever Check

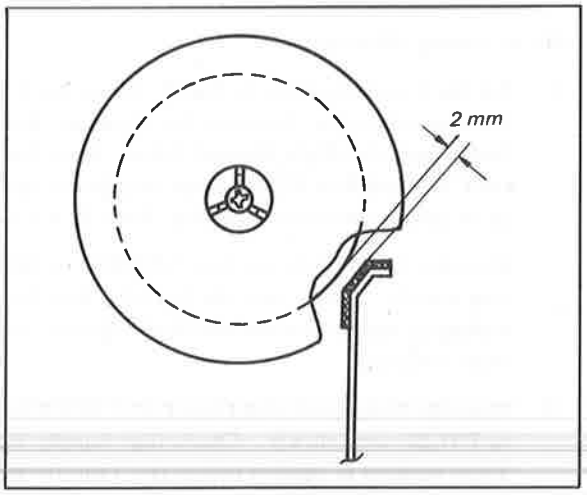
1. Set the Function Lever to STOP.
2. Check that the top end of the Brake Lever is disengaged from the Function Selector Cam by approximately 2 mm. Refer to Fig. 4-15(a).
3. Set the Function Lever to REWIND.
4. Check for a clearance of approximately 2 mm between the Brake Lever and the Take-Up Reel Table.
5. If necessary, bend the portion of the Brake Lever identified by "A" with a pair of pliers.

Pause Brake Lever Check

1. Set the Function Lever to REWIND.
2. Check for a clearance of approximately 1 mm between the Pause Brake Lever and the Supply Reel Table.
3. If this condition does not exist, turn nut "A" shown in Fig. 4-16.
4. Advance the tape. Check that the tape stops running in the PAUSE mode.
5. In the PAUSE mode, check for play between the Brake Lever and the nut.



(a) STOP mode



(b) REWIND mode

Fig. 4-15. Take-up brake lever check

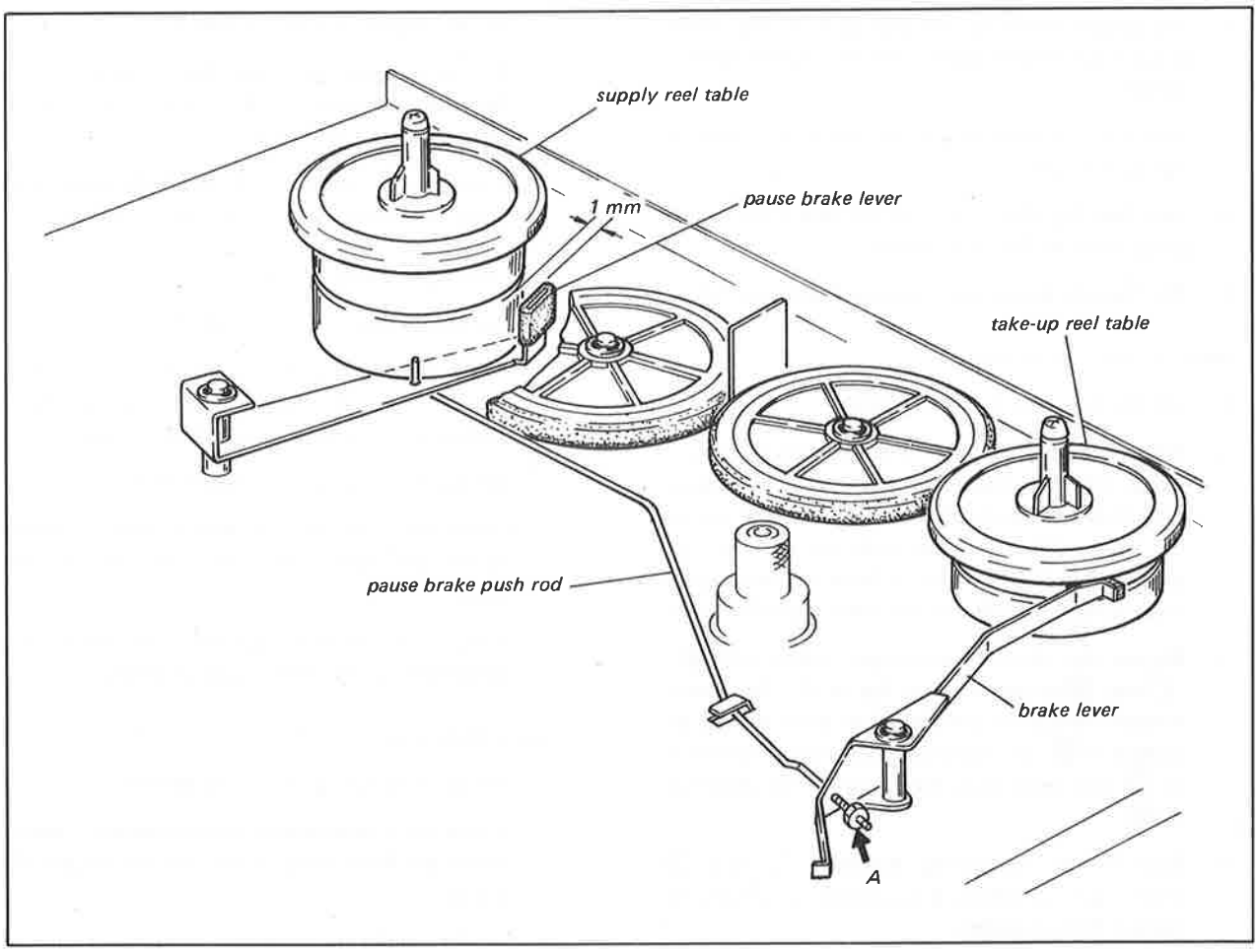


Fig. 4-16. Pause brake lever check

6. Place the Function Lever in all the modes except PAUSE. Check for clearance between the Pause Brake Lever and the Supply Reel Table. The clearance should be more than 0.5 mm.

Brake Timing Adjustment

1. Set the Function Lever to STOP. Check for a 2-2.5 mm clearance between the Capstan Motor Pulley and the Right Rewind Idler. Bend Take-Up Cam Push Rod A with a pair of pliers as needed to obtain the correct spacing. See Fig. 4-17.
2. Move the Function Lever from REWIND to STOP very slowly. Check that the Take-Up Reel Table braking is applied before the Right Rewind Idler stops rotating.
3. Move the Function Lever from FAST FORWARD to PAUSE very slowly. Check that Supply Reel Table braking is applied before the Take-Up Reel Table stops running.
4. Thread a tape on the VTR and advance it until all the tape is on the Take-Up Reel Table. Move the Function Lever from REWIND to STOP. Check that the tape stops without excess slack. If it does not, bend the Brake Lever with a pair of pliers. There should still be at least 0.5 mm clearance between the Brake Lever and the Take-Up Reel Table.
5. Place a full reel of tape on the Supply Reel Table. Move the Function Lever from FAST FORWARD to PAUSE. Repeat the procedure described in Step 4. If necessary, bend the Pause Brake Lever with a pair of pliers. Refer to "Pause Brake Lever Check" on page 4-12.

4-13. MOTOR REPLACEMENT

If the motor is suspected to be defective, check the mechanical load on the motor to make sure that the Capstan and Rotary Head Drum Assembly turn freely. Check for line voltage between the black and white leads of the motor (set the Function Lever to FORWARD). Also check phasing capacitor C001 in

series with the green lead of the motor. If line voltage is present and the phasing circuit is correct, but the motor does not turn, replace the motor as follows.

1. Stand the machine on its left side.
2. Cut the white and black motor leads at the terminal strip. Cut the green motor lead at the terminal of phasing capacitor C001. Leave 1/8″ insulation on the stubs of the leads remaining on the terminal strip and the phasing capacitor. The colored insulation will aid in locating the correct tie points for the new motor.
3. Remove the drive belt for the Rotary Head Drum Assembly.
4. Inspect the lower drive pulley on the motor shaft and note the position of the fan on the shaft. The bottom of the fan hub should be almost flush with the lower end of the motor shaft.
5. Loosen the set screw in the lower drive pulley and remove the drive pulley and fan.

   Note: Do not remove the gray plastic fan from the lower drive pulley.

6. Set the Function Lever to PAUSE. Hold the motor with one hand and back out the four Phillips-head screws from the top of the chassis.

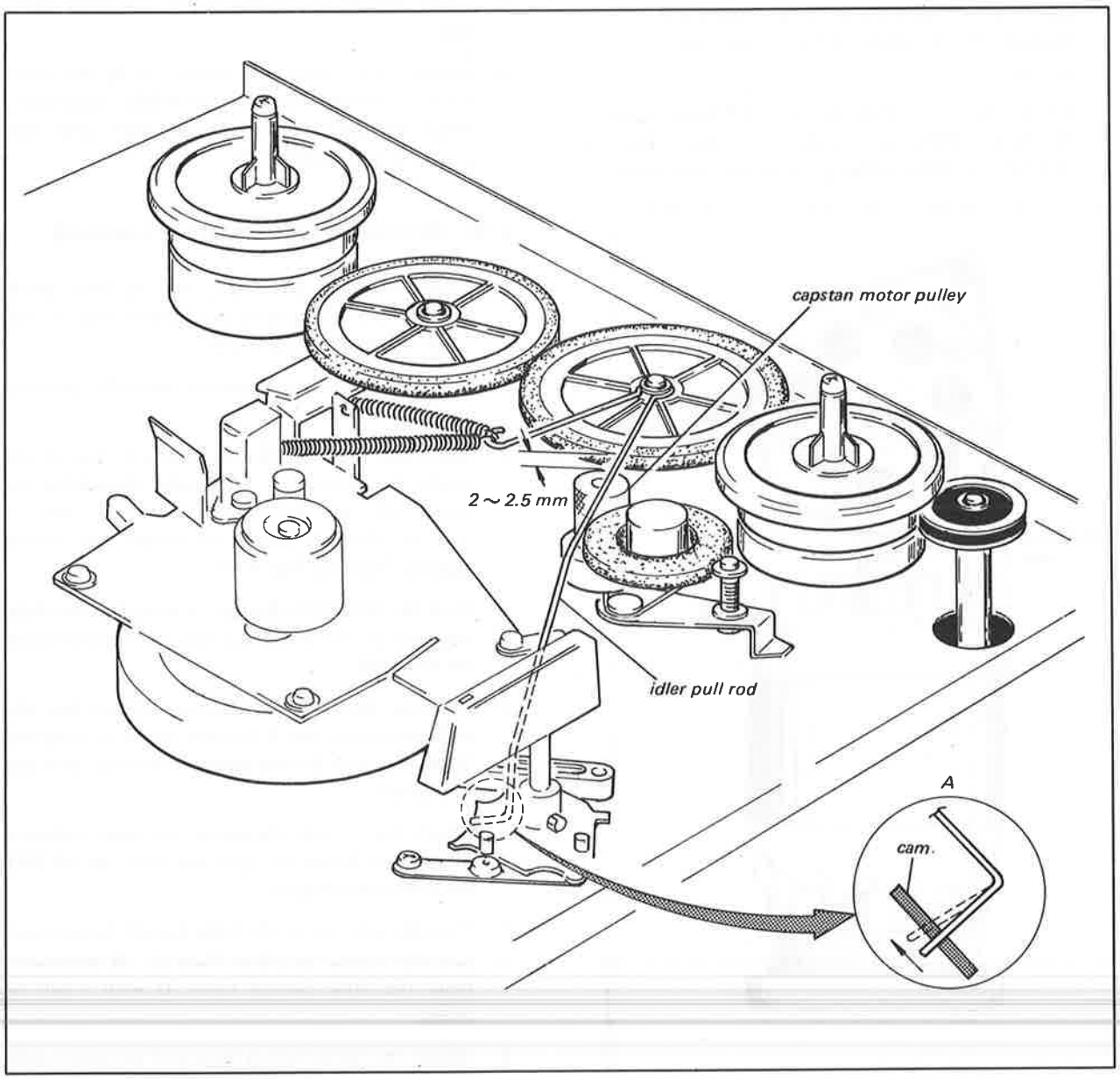


Fig. 4-17. Brake timing adjustment

7. Remove the upper (knurled) drive pulley (Capstan Pulley) from the top of the motor shaft.

8. Note the position of the hum belt (the steel band that surrounds the motor). Loosen the two screws that apply tension to the hum belt and remove the belt.

9. Install the hum belt on the new motor. Position the mounting screws as shown in Fig. 4-18. Make sure that the hum belt straddles the two end bells equally.

10. Install the top (knurled) drive pulley on the upper motor shaft. Space the bottom edge of the pulley about 4 mm from the top of the motor.

11. Insert the screws with spring washers (PS 4 x 8) through the mounting holes at the top of the chassis.

12. Put the motor in place beneath the chassis with the leads coming out toward the bracket. Make sure that the upper pulley is inside the loop of the capstan drive belt. Thread the screws installed in Step 11 into the motor end bell.

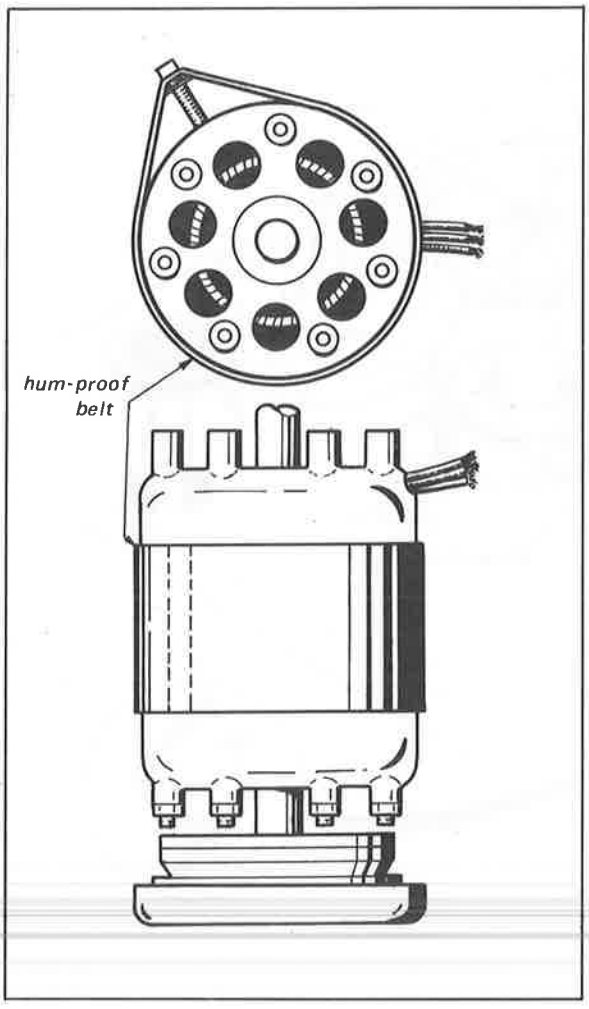


Fig. 4-18. Installation of the motor hum belt

13. Tighten all screws.

14. Check the Capstan Drive Belt to make sure it is placed properly on the Flywheel.

15. Install the lower drive pulley. Refer to Step 4 for the proper position.

16. Slide the plastic sleeve over the motor leads. Solder the motor leads to the following tie points.
    black ..... grounding lug of C001
    white ..... terminal 5 of the terminal strip
    green ..... 2.5 μF lug of C001

17. Install the Rotary Head Drum Assembly drive belt.

18. Operate the motor and check the FORWARD, FAST FORWARD, and REWIND operations. Check the running position of the lower drive belt as directed in Section 4-4.

4-14. RECORD BUTTON LATCH LINKAGE

1. Check that the RECORD and AUDIO DUB buttons can be pushed and locked only in the STOP and the PAUSE modes.

2. If the latch does not operate correctly, proceed as follows.

3. Make sure that the Record Button is clear of the Audio Set Lock Bar. Clearance should be between 0.1 and 0.3 mm. Bend "A" with a pair of pliers as needed to obtain the correct spacing. Refer to Fig. 4-19.

4. Push the RECORD Button. Check that the slide switches on the VM1, A2, and SV circuit boards are actuated.

5. Push the AUDIO DUB Button. Check that the slide switch on the A2 circuit board is actuated. If the switches do not operate correctly, proceed as follows.

6. Check for 2 mm clearance (or less) between Slide Plate B and the split nut with the AUDIO DUB Button released.

7. Turn the split nut of the Slide Switch Lever to adjust the stroke of Slide Plate C. If necessary, bend the Slide Switch Lever D with a pair of pliers.

8. Adjust the Slide Switch Springs if necessary until the clearance between the ends of the slide switches on VM1, A2, and SV, circuit boards and

the Slide Switch Springs E, F, and C is approximately 1 mm. The Slide Switch Springs are wire leaf-type springs.

9. Actuate and release the RECORD and AUDIO DUB Buttons a few times. Check that the slide switches operate correctly.

4-15. AUTOMATIC SHUTOFF SWITCH ADJUSTMENT

To check the operation of the Automatic Shut-Off Switch, turn on the power and proceed as follows.

1. Remove the tape from the normal tape path. Set the Function Lever first to FORWARD, then to PAUSE, FAST FORWARD, and REWIND. The motor should shut off in each position after about 1 second. Repeat this check with tape threaded properly. The motor should remain on when the Function Lever is set to FORWARD, PAUSE, FAST FORWARD, and REWIND.
2. Set the Function Lever to STOP, and depress the RECORD button. The motor should turn on.
3. Thread the tape on the VTR. Make sure that the motor is not shut off by a slight overshoot of the tape sensing wire. If the aforementioned conditions are not met, proceed to the following steps.
4. Set the Function Lever to STOP. Check for approximately 4 mm or more clearance between the tape surface and the sensing wire.
   If not, bend Section "A" of the sensing wire with a pair of pliers or turn the split nut at "B" shown in Fig. 4-20.

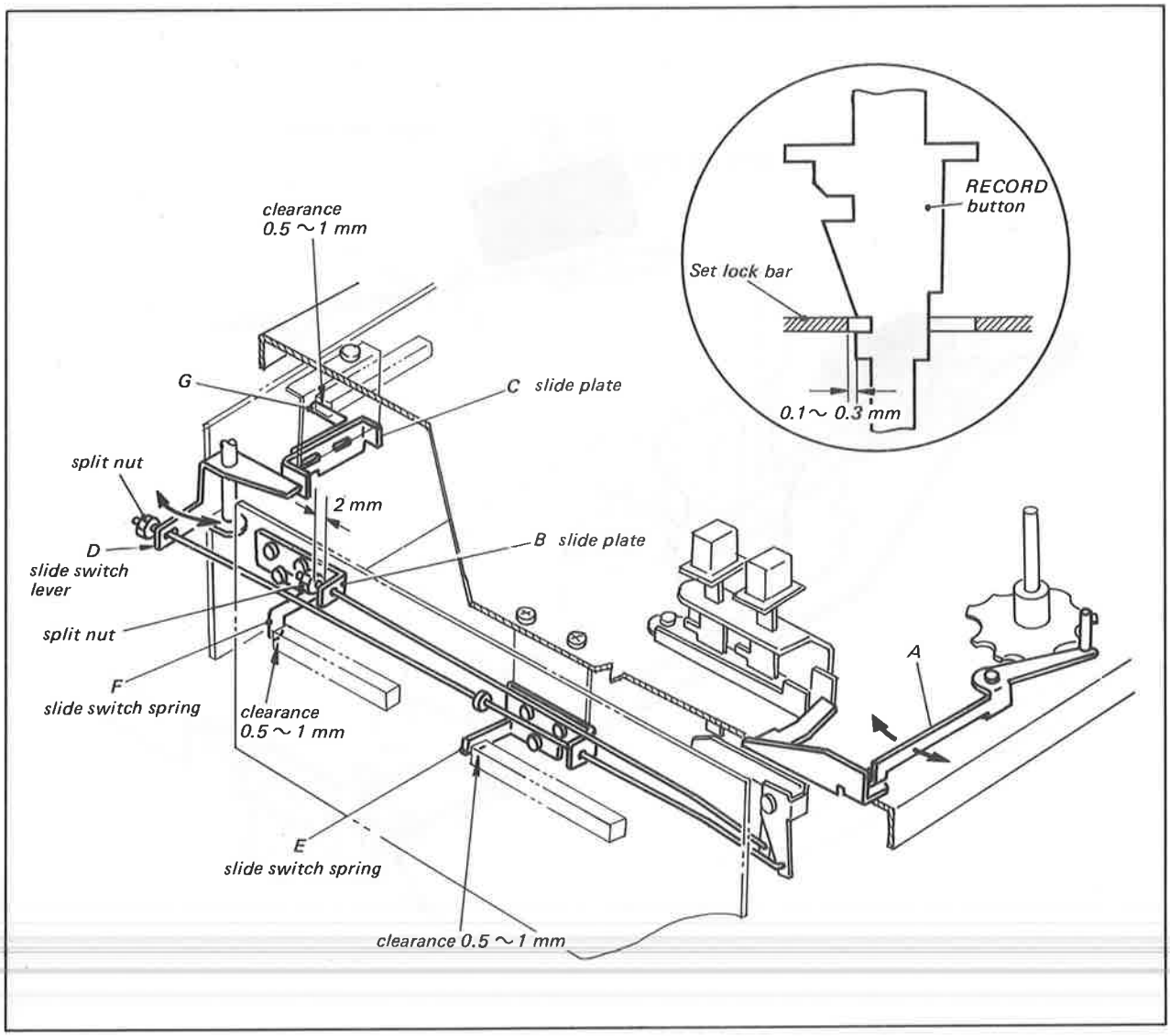


Fig. 4-19. RECORD button latching mechanism and adjustment

5. Set the Function Lever to the REWIND mode. Check that the microswitch turns off before the sensing wire is more than 3 mm beyond the tape running surface. If not, reposition the microswitch as follows:

6. Loosen the two screws that secure the microswitch to the mounting bracket or the two screws that fasten the mounting bracket to the chassis. Slide the bracket or microswitch to obtain the correct condition. See Fig. 4-20.

7. Make sure that the microswitch turns off the motor correctly in each mode.

8. Make sure that the sensing wire operates smoothly without touching the Tape Guide or the Tapered Guide.

4-16. CAPSTAN BEARING AND SHAFT REPLACEMENT

A worn Capstan Bearing results in noisy operation (a squealing sound from the capstan). When it becomes necessary to replace the Capstan Bearing, the Capstan Shaft (assembly including the Flywheel) must be replaced as well.

Proceed as follows.

1. Remove the Reel Panel.

2. Remove the screw securing the Capstan and pry off the Capstan.

3. Remove the retaining washer holding the Pull Rod to the Right Rewind Idler Shaft. Remove The Pull Rod from the Idler Shaft.

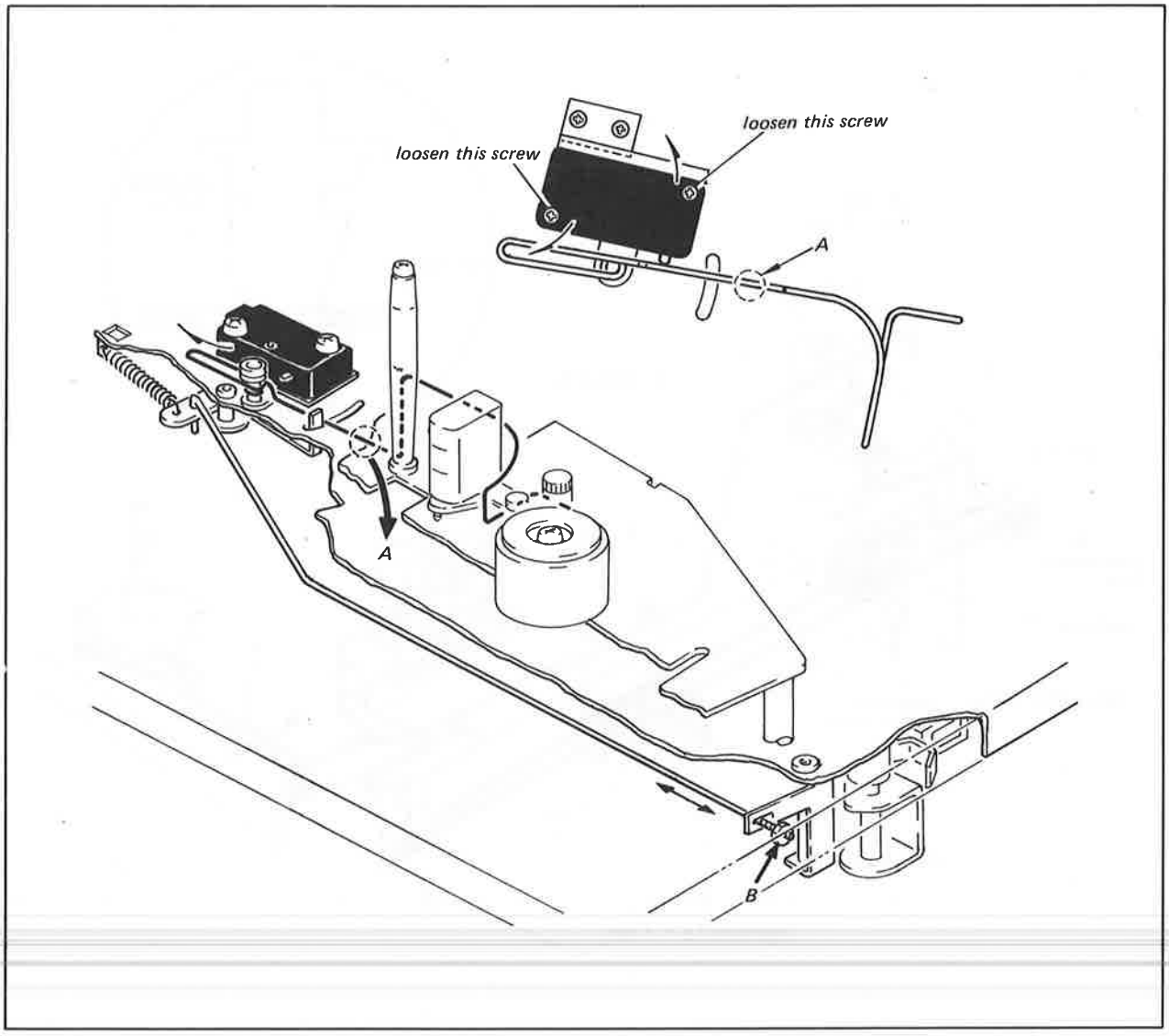


Fig. 4-20. Automatic shutoff switch adjustment

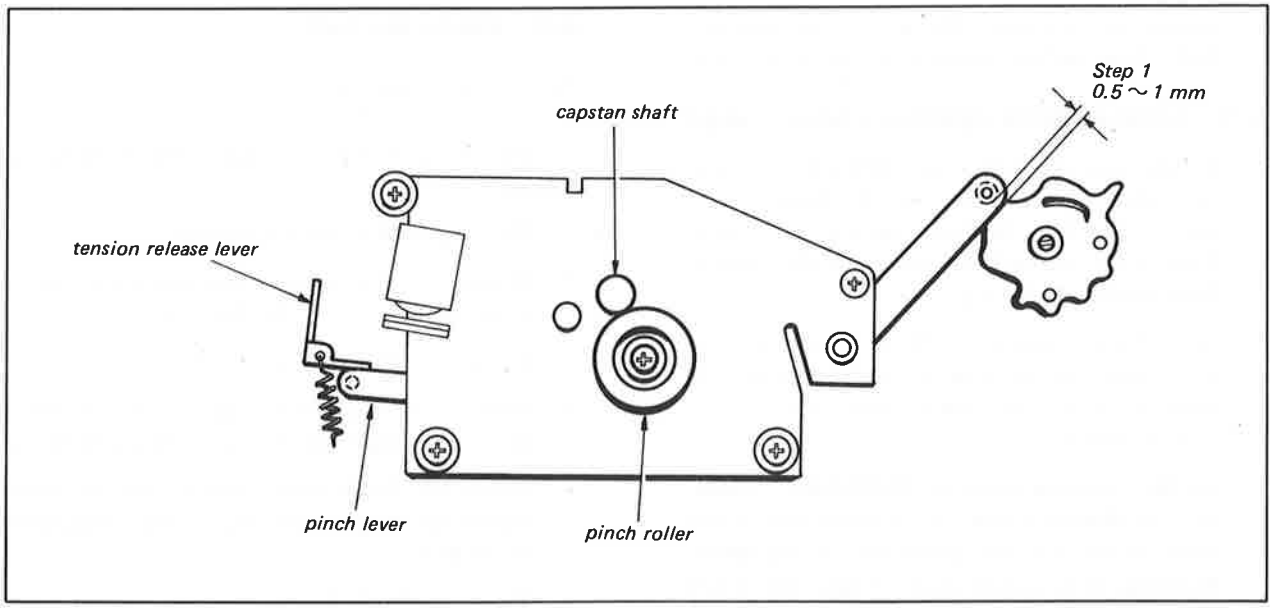


Fig. 4-21. Capstan deck adjustment

4. Remove the two springs from the Rewind Idler Push Rod.
5. Remove the four screws securing the Capstan Deck Ass'y to the support on the chassis.
6. Lift up the Capstan Deck Ass'y. Take the drive belt off the Flywheel.
7. Pull the Capstan Shaft Ass'y (Flywheel) off the Capstan Bearing on the Capstan Deck.
8. Fold the Capstan Deck Ass'y back and remove the Capstan Bearing Retainer by removing the three screws.
9. Remove the Capstan Bearing Cap from the Capstan Bearing Oil Ring and Oil Ring Retainer using a pair of pliers. Remove the Capstan Bearing.
10. Before installing the new Capstan Bearing inspect the replacement. Pass a clean lint-free cloth through the capstan hole, and inspect the inner surfaces for dirt or foreign matter.
11. Inspect the new Capstan Shaft Assembly. Handle the Capstan Shaft carefully to avoid scratches or nicks on the bearing surface.
12. Insert the Capstan Bearing into the Capstan Deck and put the Capstan Bearing Retainer on the Capstan Bearing. Tighten the three screws that secure the retainer to the chassis.
13. Place a few drops of oil on the inner surface of the bearing.
14. Put the Spacer on the Capstan Shaft. Insert the shaft into the Capstan Bearing.
15. Hold the Flywheel with one hand and slip the Oil Ring Retainer and Oil Ring onto the shaft. Place a few drops of oil on the Oil Ring, then install the Bearing Cap on the Capstan Bearing.
16. Reinstall the capstan drive belt. Install the new Capstan and replace the mounting screw.
17. Put the Capstan Deck Assembly with Flywheel on the four posts of the chassis. Position the Pinch Lever with relation to Tension Release Lever as shown in Fig. 4-21.
18. Tighten the four screws that secure the Capstan Deck Assembly to the capstan deck supports.
19. Reconnect the Pull Rod Spring to the Pull Rod.
20. Install the Pull Rod and retainer onto the Rewind Idler Shaft.

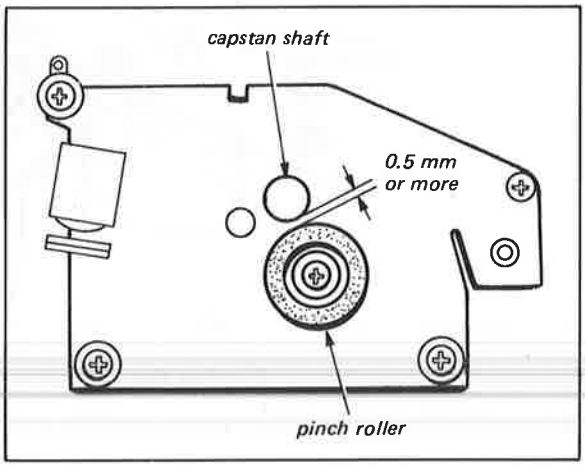


Fig. 4-22. Capstan deck adjustment

21. Operate the machine. Check servo tracking and Audio/Control Head Adjustment. See Section 4-8.

4-17. CAPSTAN DECK ASSEMBLY ADJUSTMENT

1. Set the Function Lever to FORWARD. Check that the clearance between the Pinch Lever and the Function Selector Cam is 0.5 to 1 mm. If necessary, readjust the position of the Capstan Deck Assembly. See Fig. 4-21.
2. Set the Function Lever to PAUSE. Make sure that the clearance between the Capstan Shaft and the Pinch Roller is more than 0.5 mm. If necessary, recheck Step 1.
3. Set the Function Lever to FORWARD. Check that the clearance between the upper end of the Pinch Lever and the lower end of the Drum Mounting Deck is more than 1.5 mm. See Fig. 4-23. If it needs adjustment, bend "A" in Fig. 4-23, with a pair of pliers. Recheck Pinch Roller Pressure as described in Section 4-18.
4. Switch the Function Lever through all modes. Check the tape motion.

4-18. PINCH ROLLER

Pinch Roller Replacement

Replace a worn or damaged Pinch Roller as follows.

1. Place the VTR in the STOP mode.
2. Remove the Pinch Roller Retainer and mounting screw from the top of the Pinch Roller.
3. Lift off the Pinch Roller.
4. Remove the Pinch Roller Spacer and the Pinch Roller Oil Ring from the top of the Pinch Roller.
5. Install the Pinch Roller Spacer and the Pinch Roller Oil Ring on the top of the replacement Pinch Roller.
6. Place the Pinch Roller Assembly on the Pinch Roller Shaft.
7. Install the Pinch Roller Retainer and mounting screw.
8. Test the Pinch Roller to see that it spins freely.

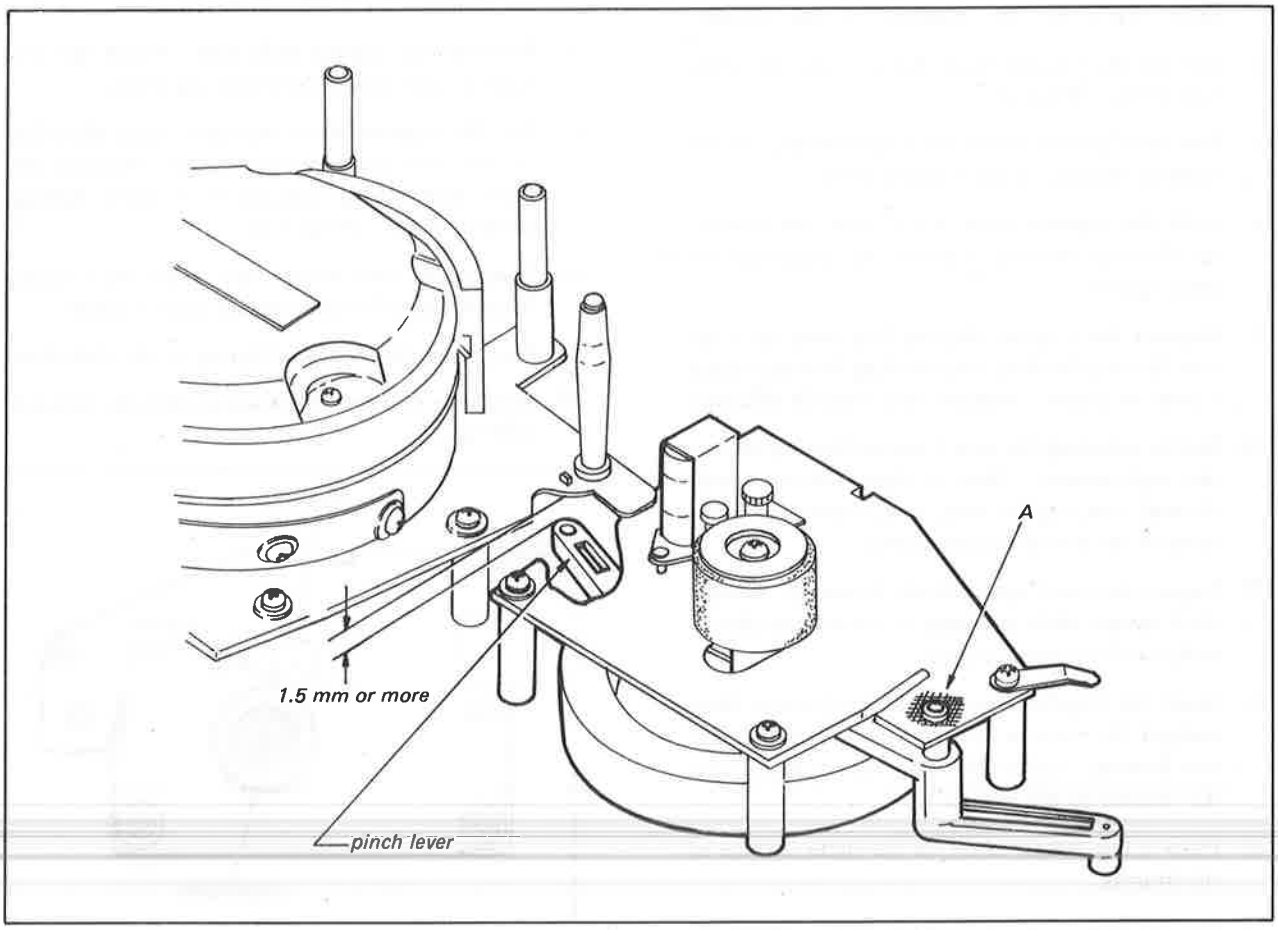


Fig. 4-23. Pinch lever adjustment

Pinch Roller Pressure Adjustment

1. Set the Function Lever to FORWARD. Check for 0.1 mm clearance between the lower end of the Pinch Roller and the Capstan Shaft when the upper end of the Pinch Roller contacts the Capstan Shaft. See Fig. 4-24. Bend "A" in Fig. 4-23 with a pair of pliers as needed to obtain the correct spacing.

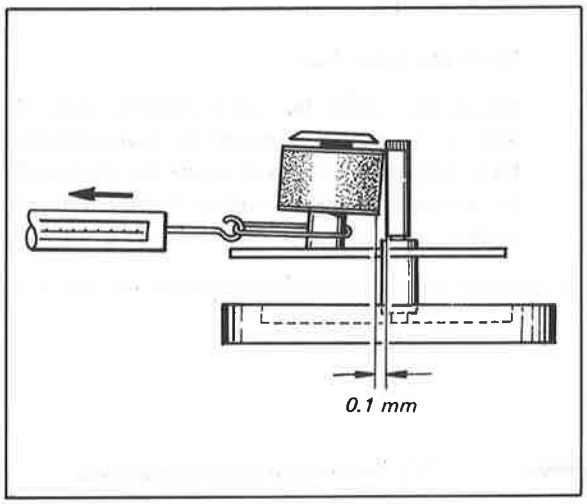


Fig. 4-24. Pinch roller adjustment

2. Place the Function Lever in the FORWARD position. Make a loop in a piece of string and attach the spring scale around the base of the Pinch Roller Shaft. See Fig. 4-24. Pull the scale in the direction indicated by the arrow. Check the reading when the Pinch Roller just leaves the Capstan Shaft. It should be between 1.5 and 2.2 kg.

4-19. MICROSWITCH MAINTENANCE AND ADJUSTMENT

1. Set the Function Lever to the STOP mode. Make sure that the switching button of the microswitch (SW3, under the chassis, beneath the Function Lever) is in the center of the cam. See Fig. 4-25. Note, the microswitch (SW3) turns off with the pushbutton pressed.
2. If it does not operate normally, loosen the mounting screw and readjust the position of the Microswitch Assembly within the slot of the Microswitch Mounting Bracket. After adjustment, apply a suitable locking compound to the mounting screw.
3. Coat the cam contacting surface with grease.

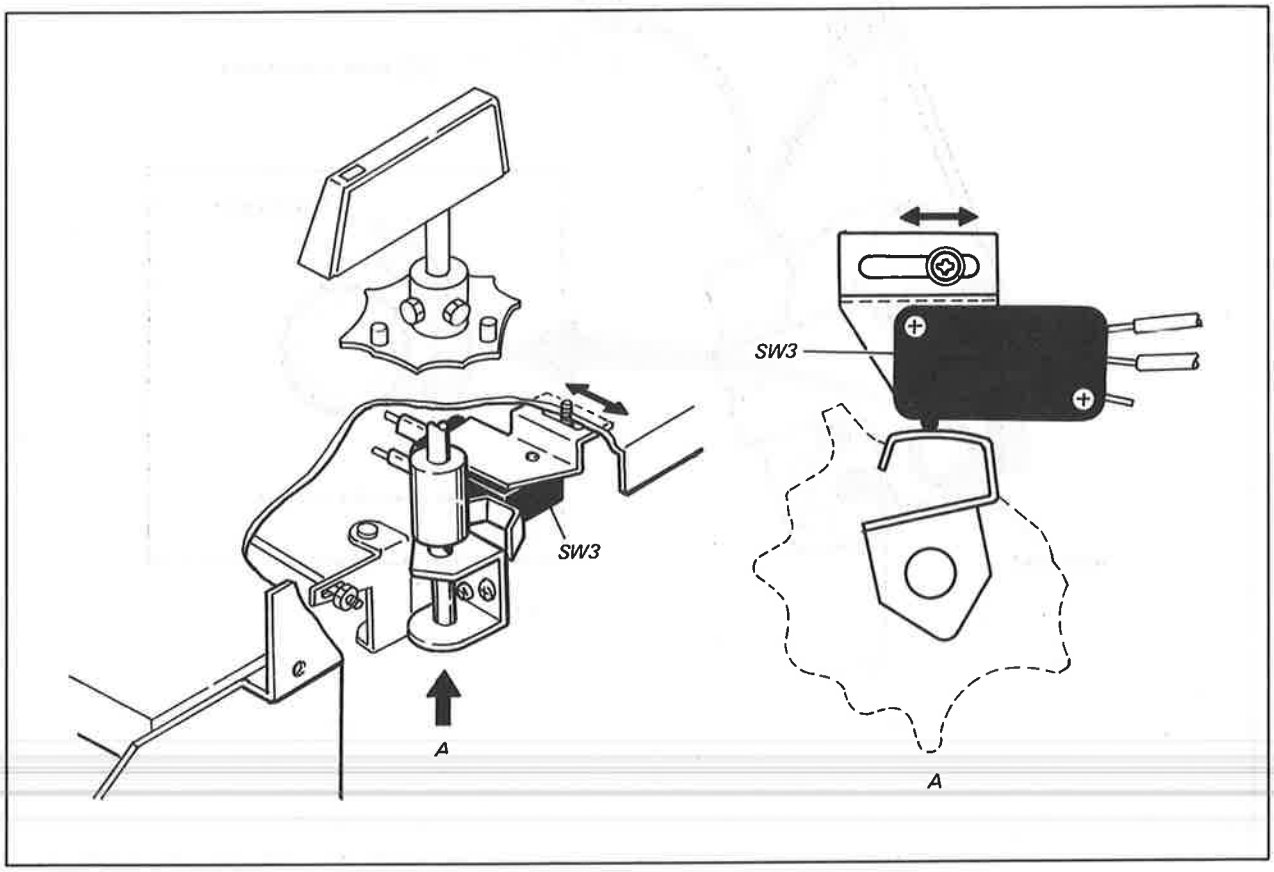


Fig. 4-25. Microswitch adjustment

4-20. SKEW CONTROL MECHANISM ADJUSTMENT

1. Check that the SKEW control knob maintains its position when turning it clockwise or counter-clockwise in the STOP mode.
2. Check that the Skew Control Lever (② in Fig. 4-26) stops Skew Control Clutch Assembly (①in Fig. 4-26) when the RECORD button is pressed and that the SKEW control knob returns to its normal position.
3. If the SKEW control knob does not return, bend Part A of the Skew Control Clutch Assembly toward the left in order to obtain 0.5 ~ 1 mm clearance between the clutch assembly and the knurled gear on the SKEW control shaft.

4-21. BELT SEPARATOR AND STATIC DISCHARGE PLATE ADJUSTMENTS

1. Belt Separator

   The Belt Separator should be situated so that in its free-standing position it fits naturally between the belt surfaces at the crossover point. See Fig. 4-27(a). Bend the Belt Separator Bracket to achieve this condition.

2. Static Discharge Plate

   Rotate the motor fan a few times to center the belt on the pulleys. Loosen the Static Discharge Plate Adjusting Screw and adjust the plate so that its extruded convex surface lightly rides the middle of the drum belt. See Fig. 4-27(b).

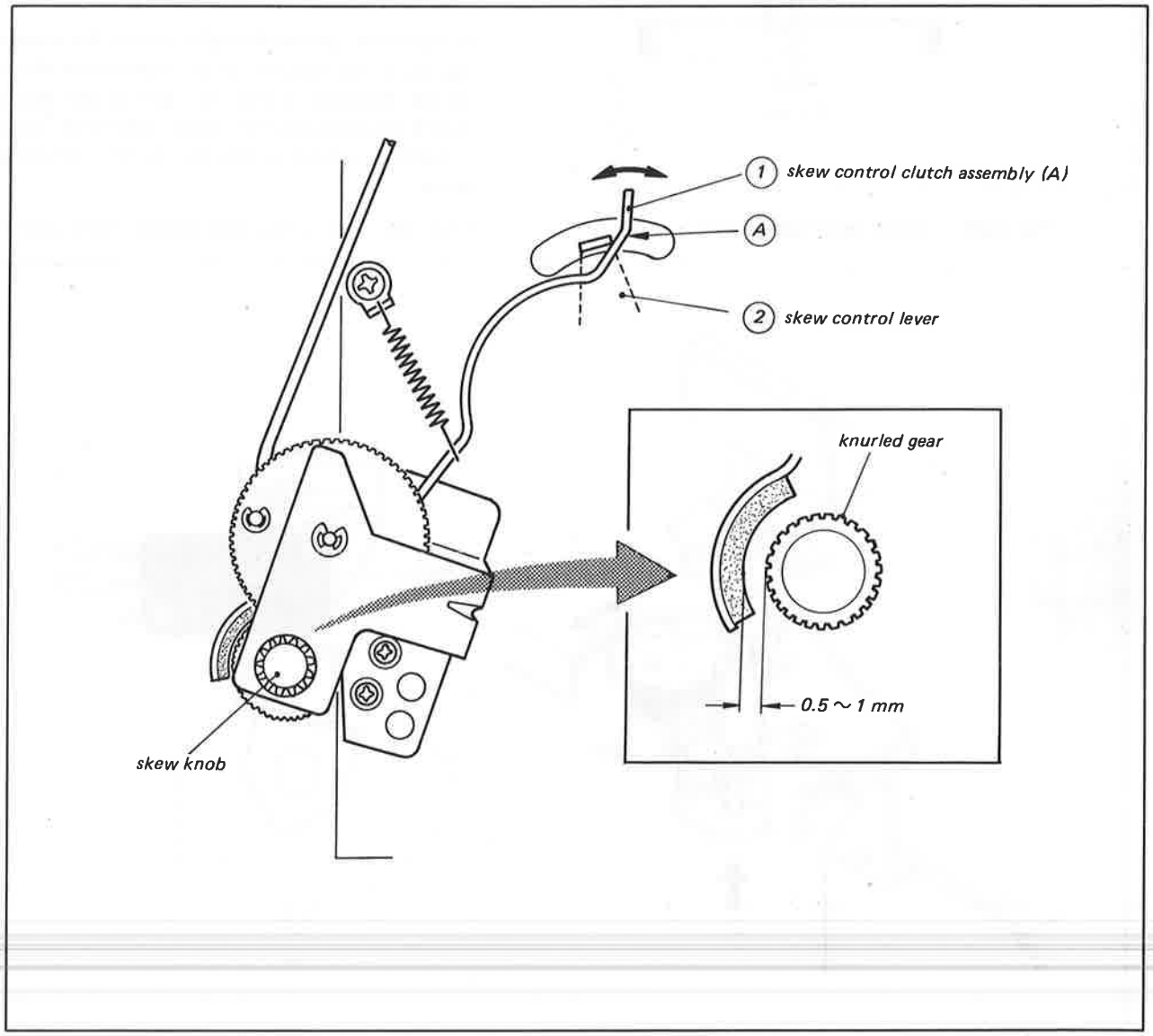


Fig. 4-26. Skew control mechanism adjustment

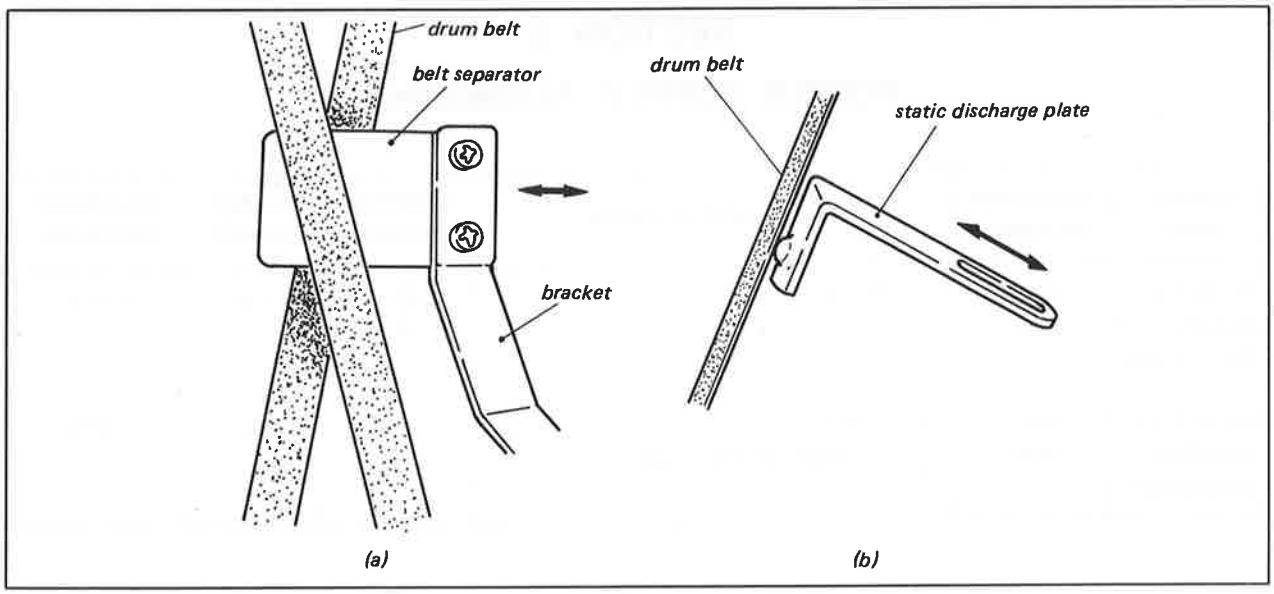


Fig. 4-27. Belt separator and static discharge plate

SECTION 5

POWER SUPPLY ALIGNMENT

	ADJUSTMENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
5-1	+B, 28 V d-c Regulated Power Supply	TP-601 (R4)	+28 V d-c	R604 (R4)	none	VTVM
5-2	+B, 10 V d-c Regulated Power Supply	TP-602 (R4)	+10 V d-c (first check +28 V d-c supply)	R610 (R4)	none	VTVM

SECTION 6
VIDEO SYSTEM ALIGNMENT

The video system alignment is divided into two procedures: Section 6-1 Luminance Signal Alignment and Section 6-2 Color Signal Alignment.

EQUIPMENT REQUIREMENTS

a. Color Receiver/
Monitor: SONY CVM-1200UA, or equivalent

b. Oscilloscope: Tektronix type 422, or equivalent

c. NTSC Color
Bar Generator: Cohu 2612 – 220, or equivalent

d. Digital Frequency
Counter: Hewlett Packard HP-5245-L, or equivalent

e. SONY Alignment Tapes
i. B/W Alignment
Tape: SONY Part No. 8-943-508-40
Contents: stairstep (5 min.), flying spot signal (3 min.), r-f sweep (3 min.), 1 kHz (5 min.), 7 kHz (6 min.).
ii. Color Alignment
Tape: SONY Part No. 8-943-508-20
Contents: color bars (6 min.), flying spot signal (4 min.), 1 kHz (6 min.), 7 kHz (4 min.).

f. (Not required but useful in precise set-up of record current)
Video Sweep Signal
Generator: Hewlett Packard 3300A with 3305A plug-in.

g. Alignment Tool: SONY Part No. 7-700-733-01

COLOR-BAR SIGNAL

Fig. 6-1 shows the 100 % color-bar signal of the Sony Color Alignment Tape, obtained at the VIDEO OUT connector. The color system alignment in Section 6-2 presumes that NTSC input color bar signal has the specifications as shown in Fig. 6-1.

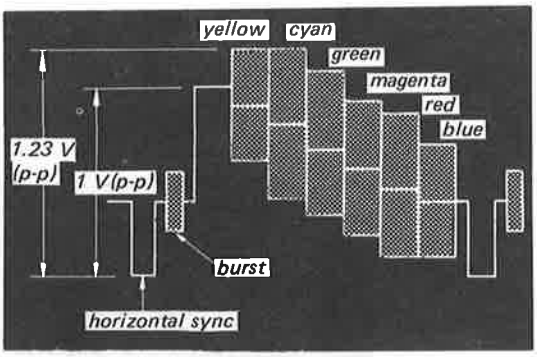
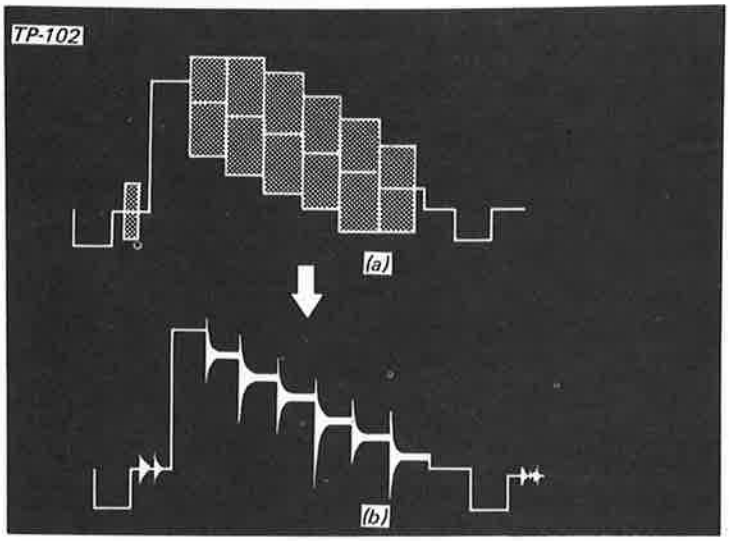


Fig. 6-1.

6-1. LUMINANCE SIGNAL ALIGNMENT

The luminance signal alignment procedure and sequence are shown below.

Subcarrier Trap Adjustment (6-1-1)
↓
Maximum Frequency Deviation Adjustment (6-1-2)
(video output level cal., sync tip carrier adj., deviation setting, white clip and dark clip adj.)
↓
Carrier Leak Adjustment (6-1-3)
↓
Modulator Output Level Adjustment (6-1-4)
↓
Record Current Adjustment (6-1-5)
↓
Playback R-f Amplifier Frequency Response Adjustment (6-1-6)
↓
Noise Eliminator Adjustment (6-1-7)

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-1	Subcarrier Trap	TP-102 (VM1)	1. Connect scope to TP-102. Set scope time base to 20 μs/cm. 2. Set up the color E-to-E mode, using a color-bar signal input 3. Adjust L101 to minimize the color sub-carrier signal as shown in Fig. 6-2-(b).	L101 (VM1)	Color Bar	Oscilloscope
			 *Fig. 6-2.*			
6-1-2	Maximum Frequency Deviation	TP-103 (VM1)	[Clip removal] 1. Terminate the TV (8-Pin) or VIDEO OUT (UHF) connector with a 75Ω terminator. 2. Connect scope to TP-103. Set scope time base to 5 ms/cm. 3. Set up the black and white E-to-E mode, using a telecast TV signal. 4. Adjust white clip and dark clip by R141 and R139, respectively, as shown in Fig. 6-3.	R139 R141 (VM1)	TV Telecast	Oscilloscope
		TP-309 or TP-310 (VD1)	[Video output level calibration] 5. Connect scope to either TP-309 or TP-310. Set scope time base to 20 μs/cm. 6. Play back the stair step portion of the SONY B/W Alignment Tape, with the COLOR⇔B/W select switch set to B/W. 7. Adjust R336 (VD1) for 1 V ± 0.05V (p-p) on the scope.	R336 (VD1)	SONY Align-ment tape	

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
Maximum Frequency Deviation (continued)	TP-104 (VM1)	[Sync tip carrier frequency setting] 8. Remove the input video signal and set up the E-to-E mode. 9. Connect a digital frequency counter to TP-104. Adjust R129 for a 3.3 MHz ± 0.05 MHz counter reading. If a frequency counter is not available, use an oscilloscope and adjust as follows: a. Adjust scope time base for 1 μsec per division (calibrated). b. Set scope controls to obtain a stable trace. A correct carrier frequency of 3.3 MHz is indicated when there are 33 complete sine waves in ten division. Set R129 to produce this indication.	R129 (VM1)	none	Digital frequency counter or Oscilloscope
	TP-309 or TP-310 (VD1)	[Frequency deviation setting] 10. Feed a telecast TV signal to the VIDEO IN connector in the E-to-E mode. 11. Connect scope to TP-309 or TP-310 (terminated). 12. Adjust R123 for 1.0 V(p-p) on scope.	R123 (VM1)	Telecast TV	Oscilloscope
	TP-103 (VM1)	[White clip and dark clip settings] 13. Connect scope to TP-103. Set scope time base to 5 ms/cm. 14. Adjust R139(dark clip) and R141 (white clip) so that the positive excursion of the video signal is clipped at 50 %, while the negative excursion is clipped at the −30 % level, as shown in Fig. 6-3.	R139 (d. clip) R141 (w. clip) (VM1)	Telecast TV	Oscilloscope

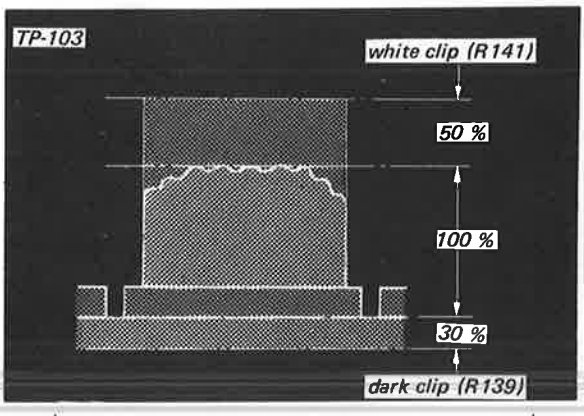


Fig. 6-3.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-3	Carrier Leak	Monitor screen	1. Set up the black and white E-to-E mode using a telecast TV signal or test signal, preferably the camera output of a gray-scale chart. 2. Adjust R311 and R329 for minimum carrier leak (herringbone pattern) on the monitor screen. 3. Adjust R155 and C124 for minimum carrier leak. 4. Repeat Steps 2 and 3 a few times to achieve optimum condition. 5. Record a test signal and play back the tape. Adjust R311 again.	R311 R329 (VD1) R155 C124 (VM1)	Test Signal	Monitor
6-1-4	Modulator Output Level	TP-104	1. Set up the color E-to-E mode using a telecast TV signal. 2. Connect scope to TP-104 and note the amplitude. 3. Set the COLOR-B/W select switch to B/W and adjust R168 so that the amplitude at TP-104 in the black and white mode is equal to that in the color mode.	R168 (VM1)	Telecast TV	Oscilloscope
6-1-5	Record Current		Note, procedure A is the simplified procedure requiring no special equipment. Procedure B is the exact procedure requiring use of a video sweep generator.			
		CH-A (TP-105) CH-B (TP-106) (VM1)	*Procedure A* 1. Connect scope to TP-105 (TP-106), with time base set to 5 ms/cm. Sync the scope externally from TP-406. 2. Set up the record mode. 3. Adjust R174 (R182) for 4.0 V(p-p). See Fig. 6-4.	R174 (CH-A) R182 (CH-B) (VM1)	Telecast TV	Oscilloscope
		CH-A (TP-105) CH-B (TP-106) (VM1)	*Procedure B* 1. Unsolder either end of the lead connected between TP-104 and C135.	R174 R178 (CH-A)	Video Sweep Signal	Oscilloscope

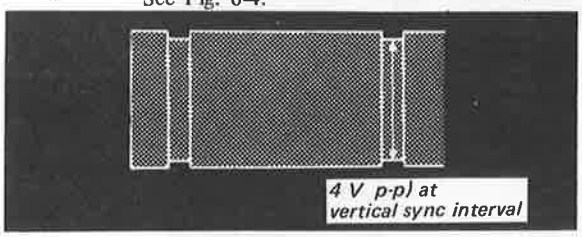
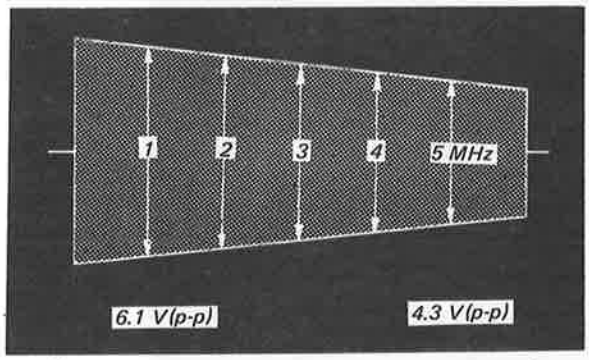


Fig. 6-4.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			2. Feed the video sweep generator output to C135 3. Set the sweep generator output to 0.7V (p-p). Select marker frequencies of 1 MHz and 5 MHz. 4. Connect scope to TP-105 (TP-106) and set up the record mode. 5. Adjust R174 (R182) for 6.1 V(p-p) ± 0.6 V(p-p) at 1 MHz. 6. Check that the signal amplitude at 5 MHz is 4.3 V ± 0.5 V(p-p). If not, replace R178 (R186) with a value in the range of 0 to 20 Ω, and recheck amplitude at 1 MHz. 7. Reconnect the lead removed in Step 1.  *Fig. 6-5.*	R182 R186 (CH-B) (VM1)		
6-1-6	Playback R-f Amplifier Frequency Response	TP-201 (VM1)	Two equivalent amplifiers are used for CH-A and CH-B video heads make adjustment for both channels. 1. Connect scope to TP-201 with time base set to 2 ms/cm. Sync the scope externally from TP-402 (CH-A) or TP-401 (CH-B) on the SV board. 2. Play back the r-f sweep portion of the SONY alignment tape. The five markers in the waveform indicate the 1 MHz, 2 MHz, 3.58 MHz, 4.5 MHz and 5 MHz points, from left to right. 3. Turn R201 (R202) fully clockwise. 4. Adjust C201 (C204) for maximum amplitude at 5.2 MHz. See Fig. 6-6.	R201 C201 (CH-A) R202 C204 (CH-B) R211 L204 (VM1)	SONY Alignment Tape (B/W)	Oscilloscope

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED

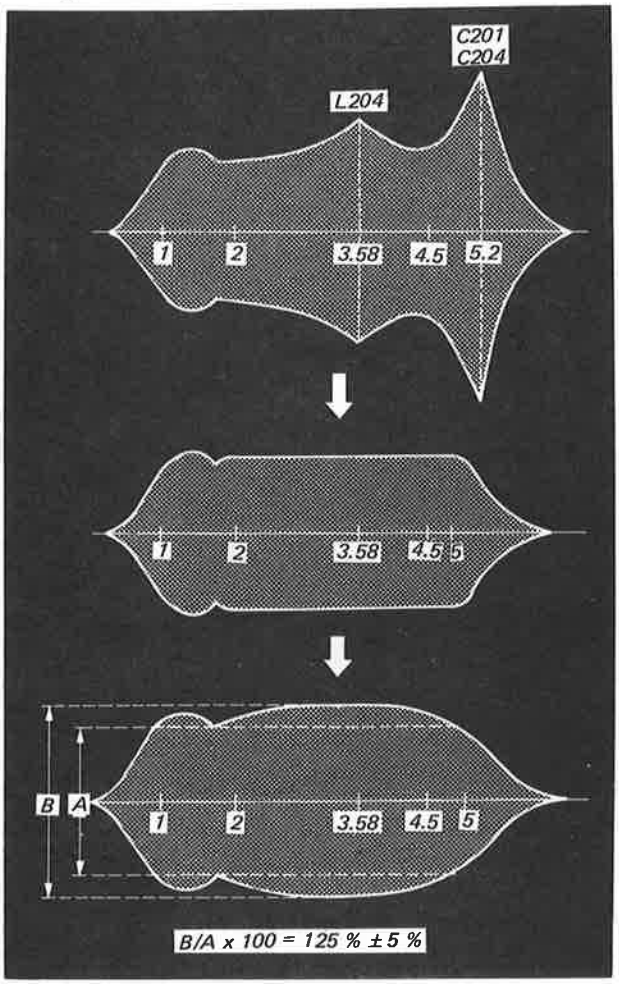
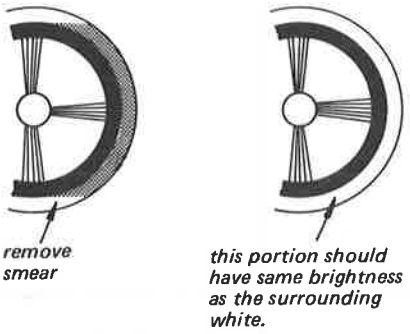


Fig. 6-6.

5. Turn R211 fully clockwise. Adjust L204 to peak at 3.58 MHz.
6. Obtain flat response by adjusting R201 (R202) for 5 MHz amplitude and R211 for 3.58 MHz amplitude.
7. Adjust R211 (Common to Channels A and B) to increase the amplitude B by 25 % as shown in Fig. 6-6.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-7	Noise Eliminator	Monitor Screen	1. Record and reproduce the test signal, preferably the camera output of a resolution chart. 2. Turn R353 fully counterclockwise. 3. Decrease the BRIGHTNESS of the monitor. 4. Adjust R353 so that the smear is removed and the portion indicated in Fig. 6-7 has the same brightness as the ambient white. 5. After completing the adjustment, check the portion of the horizontal sync shown in Fig. 6-7 that the amplitude of undershoot is less than 30 % of amplitude of horizontal sync. If not, readjust R353.	R353 (VD1)	Test Signal Preferably Camera Output of a Resolution Chart	Monitor



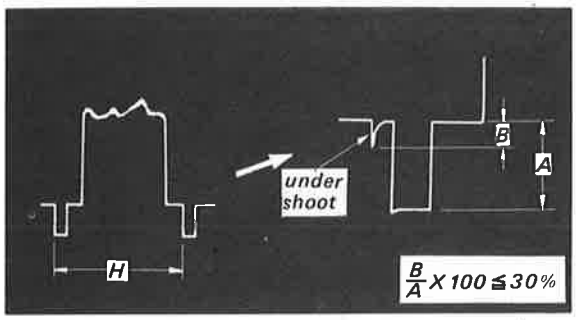
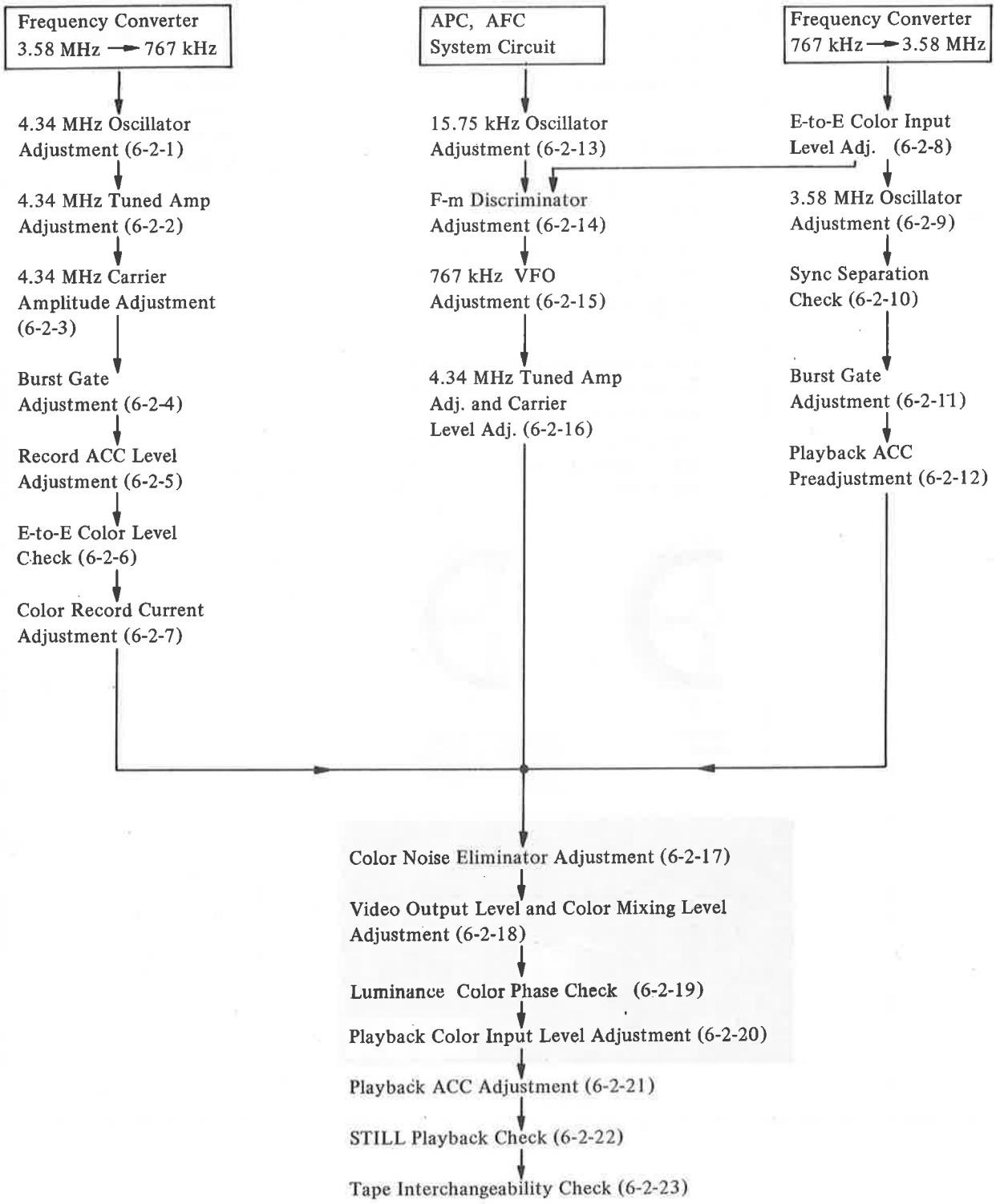
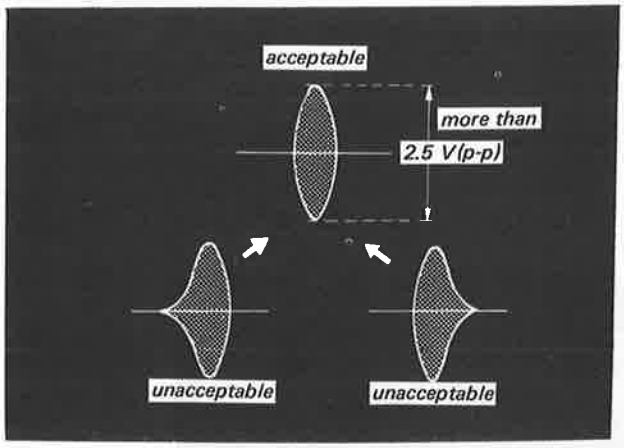
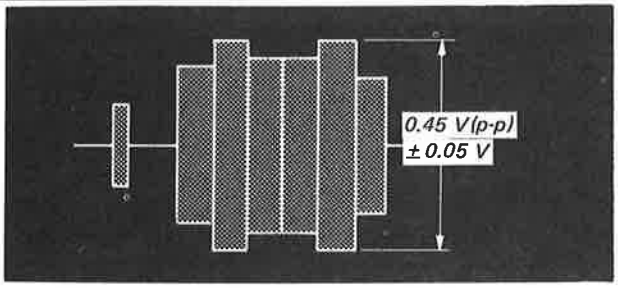
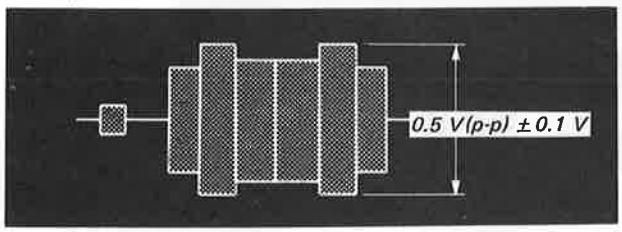


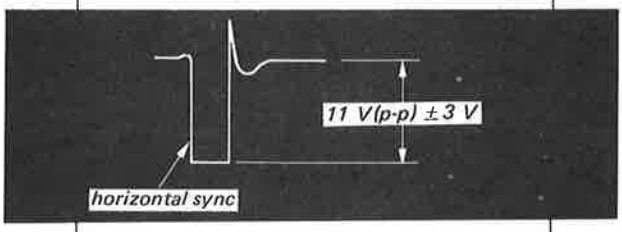
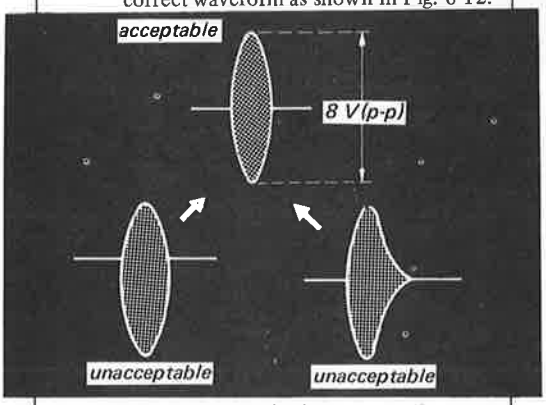
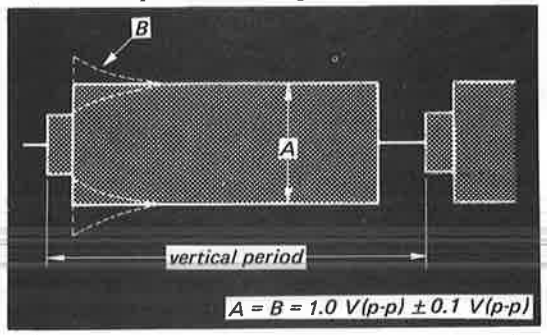
Fig. 6-7.

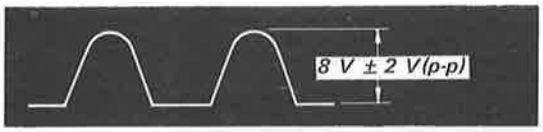
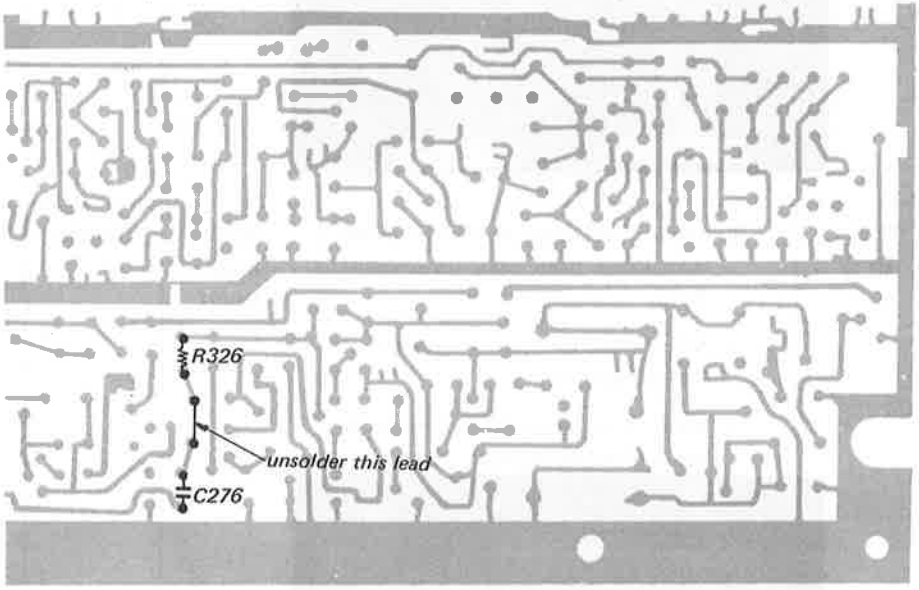
6-2. COLOR SIGNAL ALIGNMENT

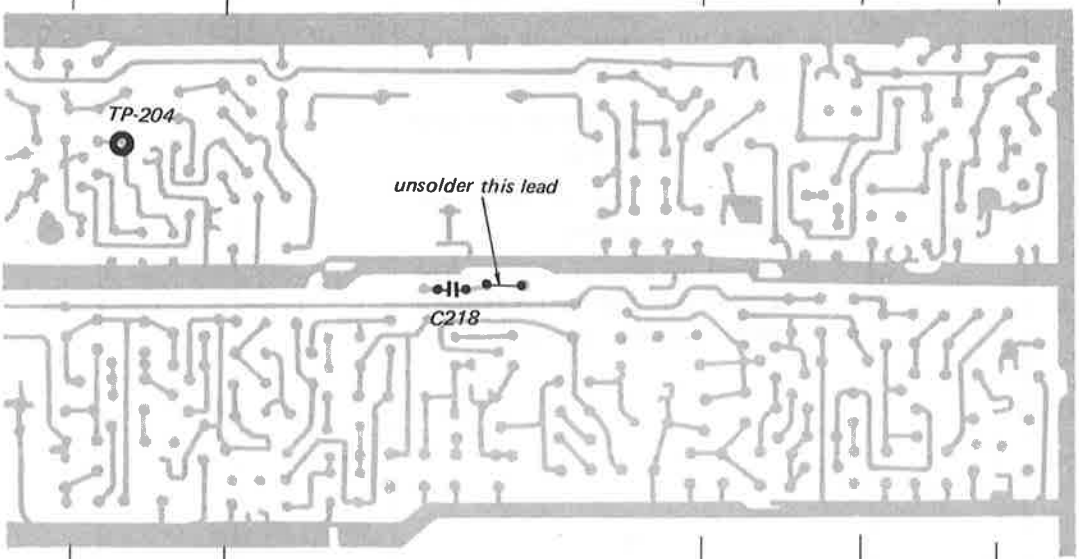


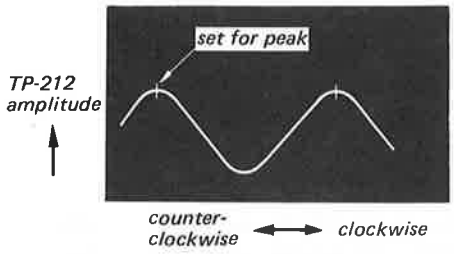
	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Frequency converter 3.58 MHz →767 kHz					
6-2-1	4.34 MHz Oscillator	TP-107 (MC1)	1. Connect a digital frequency counter to TP-107. If the input impedance of the counter is lower than 1 MΩ, connect the scope to TP-107, and connect the counter to scope preamplifier output connector. 2. Set up the color E-to-E mode with no input signal. 3. Adjust C131 for 4.346590 MHz ± 10 Hz	C131 (MC1)	No Signal	Digital Frequency Counter
6-2-2	4.34 MHz Amplifier	TP-107 (MC1)	1. Connect scope to TP-107. 2. Set up the color E-to-E mode. 3. Adjust L105 for maximum amplitude.	L105 (MC1)	No Signal	Oscilloscope
6-2-3	4.34 MHz Carrier Amplitude	TP-107 (MC1)	1. With the same set-up as in Section 6-2-2, adjust R149 for 3.5 V(p-p) ± 0.3 V(p-p).	R149 (MC1)	No Signal	Oscilloscope
6-2-4	Burst Gate	TP-106 (MC1)	1. Connect scope to TP-106 in the color E-to-E mode using a color-bar signal. Adjust L104 and T103 for correct waveform as shown in Fig. 6-8.  *Fig. 6-8.*	L104 T103 (MC1)	Color Bars	Oscilloscope
6-2-5	Record ACC Level	TP-102 (MC1)	1. Connect scope to TP-102, in the color E-to-E mode, using the color-bar signal. 2. Adjust R140 for 0.45 V± 0.05 V(p-p) See Fig. 6-9.	R140 (MC1)	Color Bars	Oscilloscope

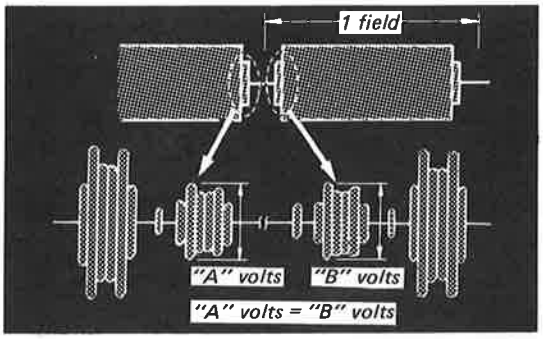
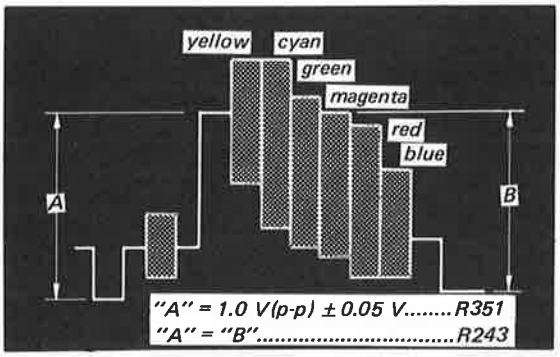
	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			 *Fig. 6-9.*			
6-2-6	E-to-E Mode Color Level Check	TP-103 (MC1)	1. Connect the scope to TP-103 in the color E-to-E mode, using the color bar signal. 2. Check for signal amplitude of 1.1 V ± 0.2 V(p-p).	none	Color Bars	Oscilloscope
6-2-7	Color Record Current	TP-105 (VM1)	Confirm that the record current adjustment of the VM1 Board is correct. Remove the lead wire that is connected to TP-104 on the VM1 Board. Connect the scope to TP-105 or TP-106. Adjust R125 on the MC1 Board for 0.8 ± 0.08 V(p-p). Reconnect the lead wire, after completing adjustment. 6-2-7, Color Record Current.	R125 (MC1)	Color Bars	Oscilloscope
	Frequency converter 767 kHz → 3.58 MHz					
6-2-8	E-to-E Mode Color Input Level	TP-202 (MC1)	1. Connect the scope to TP-202, in the color E-to-E mode, using the color-bar signal. 2. Adjust R202 for 0.5 V ± 0.1 V(p-p).	R202 (MC1)	Color Bars	Oscilloscope
			 *Fig. 6-10.*			
6-2-9	3.58 MHz Oscillator	TP-206 (MC1)	1. Connect the digital frequency counter and the scope to TP-206 in the color E-to-E mode, with no input signal. 2. Adjust frequency for 3,579545 MHz ± 10 Hz and check for amplitude of 3 V(p-p) or more.	C228 (MC1)	No Signal	Digital Frequency Counter Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-2-10	Sync Separation	TP-214 (MC1)	1. Connect the scope to TP-214 in the color-E-to-E mode, using the color-bar signal. 2. Check the separated sync signal as shown in Fig. 6-11.  *Fig. 6-11.*	none	Color Bars	Oscilloscope
6-2-11	Burst Gate	TP-208 (MC1)	1. Connect the scope to TP-208 in the color E-to-E mode using the color-bar signal. 2. Adjust the core of T203 to obtain the correct waveform as shown in Fig. 6-12.  *Fig. 6-12.*	T203 (MC1)	Color Bars	Oscilloscope
6-2-12	Playback ACC Preadjustment	TP-203 (MC1)	1. Connect the scope to TP-203, in the color E-to-E mode using the color-bar signal. 2. Adjust R222 for 1.0 V ± 0.1 V(p-p) at "A" in Fig. 6-13. 3. Adjust R323 to obtain "B" amplitude equal to "A" in Fig. 6-13.  *Fig. 6-13.*	R222 R323 (MC1)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Playback ACC Preadjustment (continued)		This is the preliminary adjustment in E-to-E mode. Final adjustment is required in the playback mode. Refer Section 6-2-21.			
			APC, AFC Circuit			
6-2-13	15.75 kHz Oscillator	TP-216 (MC1)	1. Unsolder either end of the lead connected between C276 and R326. See Fig. 6-15. 2. Connect the digital frequency counter and the scope to TP-216 in the color E-to-E mode. 3. Adjust R331 for 15,734 Hz ± 100 Hz and check amplitude. Reconnect lead wire after adjustment.	R331 (MC1)	Color Bars	Oscilloscope, Digital Frequency Counter
			 *Fig. 6-14.*			
			4. Adjust R337 for 10 V ± 1 V(p-p), confirming that the frequency counter reading is 15,734 Hz using the color-bar signal.	R337 (MC1)		
			 *Fig. 6-15.*			
6-2-14	F-m Discriminator	TP-217 (MC1)	1. Connect the scope to TP-217. Set the scope INPUT SELECTOR to DC. 2. Set up the color E-to-E mode using the color-bar signal.	R348 L213 (MC1)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	F-m Discriminator (continued)		3. Turn R348 fully counterclockwise. 4. Adjust L213 (from the component side of the board) for 0 V ± 0.1 V(d-c). 5. After completing adjustment, the 767 kHz VFO adjustment (6-2-15) should be made.			
6-2-15	767 kHz VFO	TP-209 (MC1)	1. Connect the scope to TP-209. Set the scope INPUT SELECTOR to DC. 2. Unsolder either end of the lead connected between C218 and TP-204. See Fig. 6-16. 3. Adjust R346 for 2.5 V ± 0.1 V(d-c).	R346 (MC1)	Color Bars	Oscilloscope
			 *Fig. 6-16.*			
		TP-210 (MC1)	4. Using a hex alignment tool, adjust L208 for 767.045 Hz ± 100 Hz 5. Reconnect the lead unsoldered in Step 1.	L208 (MC1)	Color Bars	Digital Frequency Counter
6-2-16	4.34 MHz Tuned Amp. and Carrier Level	TP-211 (MC1)	1. Connect the scope to TP-211 in the E-to-E mode using the color-bar signal. 2. Adjust L209 for maximum amplitude.	L209	Color Bars	Oscilloscope
		TP-212 (MC1)	3. Turn the cores of L210 and L211 fully counterclockwise. Then turn them clockwise and set them to the first tuned frequency that produces maximum output, since the amplifier has two tuned frequencies.	L210, L211		

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
4.34 MHz Tuned Amp. and Carrier Level (continued)		 *Fig. 6-17.*			
	TP-204 (MC1)	4. Connect the scope to TP-204. 5. Adjust R306 for 4.0 V ± 0.2 V(p-p). 6. Turn L210 clockwise until the signal level is 3 V ± 0.15 V(p-p). 7. Turn L211 counterclockwise until signal level is 2 V ± 0.1 V(p-p).	R306 (MC1)		
	TP-210 (MC1)	8. Connect the scope to TP-210 and measure the signal level. 9. Connect the scope to TP-204. Adjust R306 so that signal level at TP-204 is TP-210 amplitude plus extra 0.2 V.			
6-2-17 Color Noise Eliminator	C504 (C3)	1. Connect the scope to either side of C504, in the color E-to-E mode. 2. Set the scope time base to 2 ms/cm. Pull out the 5X magnifier and adjust the POSITION control to observe the last horizontal line of a field and check the level as shown in Fig. 6-18. 3. Adjust R1506 to equalize the first line of the following field to the last line of the field being observed.	R1506 (C3)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			 Fig. 6-18.			
6-2-18	Video Output Level and Color Mixing Level	TP-310 (VD1)	1. Terminate the VIDEO OUTPUT receptacle with a 75 Ω terminator. 2. Set up the color E-to-E mode using the color-bar signal. 3. Connect the scope to TP-310. Adjust the luminance level with R351 for 1 V ± 0.05 V(p-p) and color level with R243 as specified in Fig. 6-19.  Fig. 6-19.	R351 R243 (MC1)	Color Bars	Oscilloscope
6-2-19	Luminance Color Phase	Monitor Screen	(This adjustment is necessary only when the delay line is replaced.) DL-201 delays the luminance signal so that the color and luminance signals arrive at the output at the same time. DL-201 contains 10 internal series-strung delay elements that can be connected or disconnected externally as required to provide the correct amount of delay, as may be observed on the monitor screen. 1. Set up the E-to-E mode using the color-bar signal. 2. Check the color monitor screen to determine whether the color signal lags or leads the luminance signal.	DL-201 (MC1)	Color Bars	Color Monitor

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED

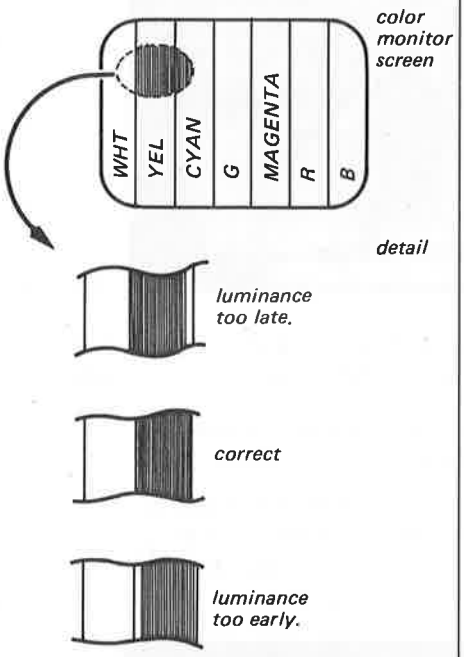
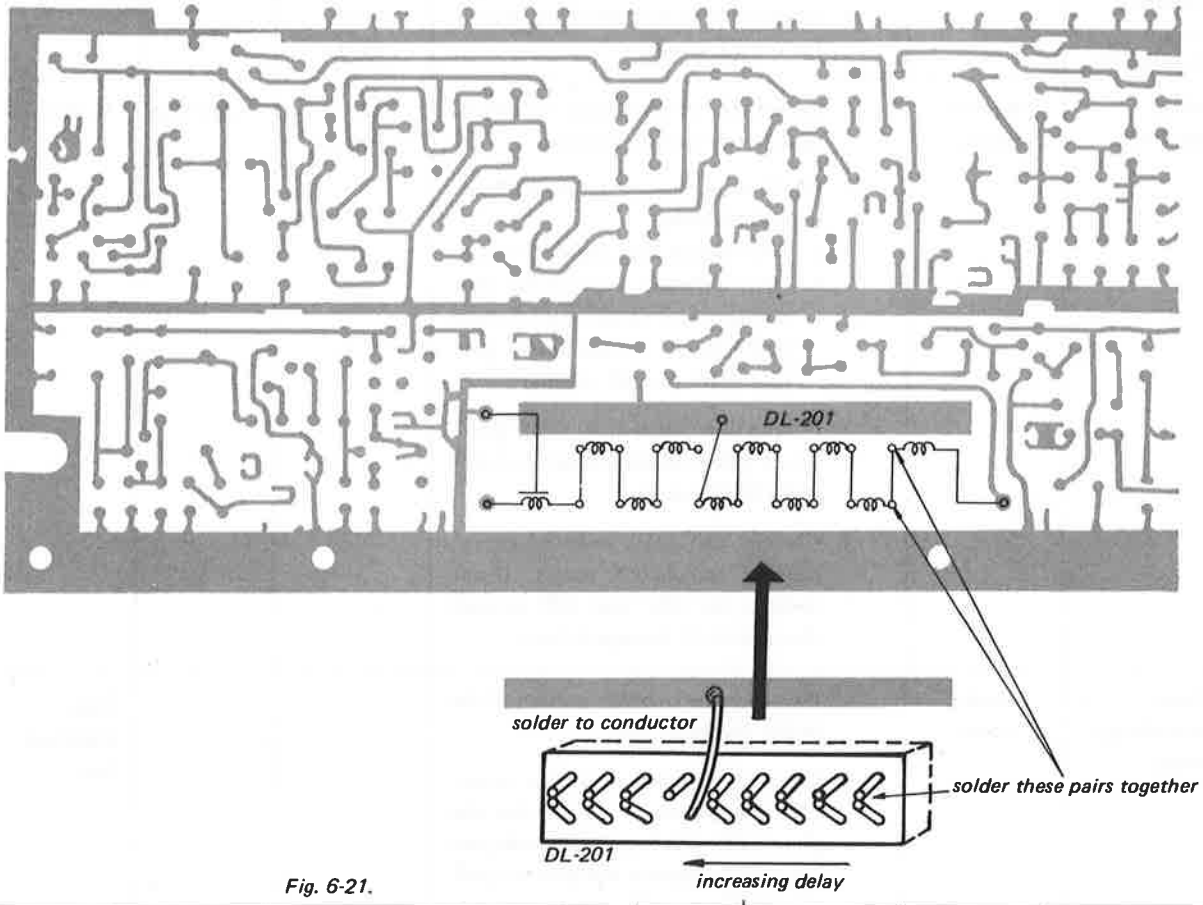


Fig. 6-20.

The delay line terminals are arranged in pairs which, when connected together (starting from the extreme right pair and on consecutively toward the left) add delay elements, thus increasing delay time. To adjust the delay, display a color bar pattern on the monitor. If the luminance signal precedes the chrominance signal (luminance too early), decrease the number of series-connected elements. If the luminance signal is too late, increase the number of series-connected elements.

For example, if six delay elements need to be connected in series, solder the first five pairs of upper and lower taps to each other and solder the lower tap of the sixth element to the conductor as shown in Fig. 6-21. Luminance delay time increases with the number of elements strung from right to left.

ADJUST MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
		 Fig. 6-21.			
6-2-20	Playback Color Input Level	TP-202 (MC1)	1. Thread a blank tape and record the color-bar signal for two to three minutes. 2. Connect the scope to TP-202 and play back the tape. 3. Adjust R202 for 0.5 V ± 0.1 V(p-p).	R202 (MC1)	Color Bars	Oscilloscope
6-2-21	Playback ACC	TP-203 (MC1)	1. Record the color-bar signal on a blank tape for two to three minutes. 2. Connect the scope to TP-203 and play back the tape. 3. Adjust R222 so that "A" of Fig. 6-22 is 1.0 V ± 0.1 V(p-p).	R222 (MC1)	Color Bars	Oscilloscope

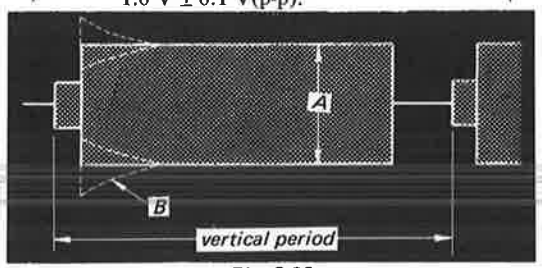


Fig. 6-22.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Playback ACC (continued)		4. Adjust R323 so that "B" of Fig. 6-22 is 1.0 V ± 0.1 V(p-p).	R323 (MC1)		
6-2-22	STILL Playback	Monitor Screen	1. Record the color-bar signal on a blank tape for two to three minutes. 2. Play back the tape and put the VTR into the PAUSE mode. a. Color should lock within 1 second. b. Phase difference between the color and luminance signals on the monitor screen should be less than 1 μsec (i.e., 3/16″ on a 12″ screen.) 3. If color does not lock in, adjust R337 (15.75 kHz oscillator output level adj.) in the PAUSE mode. 4. Confirm that color locks in normal playback and PAUSE modes. If not, readjust the AFC and APC systems (Section 6-2-13 through 6-2-16).	R337 (MC1)	Color Bars	Monitor
6-2-23	Tape Interchange-ability	Monitor Screen	1. Play back the color-bar portion of the SONY alignment tape. 2. Check the monitor screen for correct color reproduction. Check that the phase difference between the color and luminance signals is less than 0.5 μsec (i.e., 1/16″ on a 12″ screen).			Color Alignment Tape

SECTION 7

SERVO AND PULSE SYSTEM ALIGNMENT

The servo and pulse system alignment procedure and sequence are shown below.

Section 7-1 **Record Mode Servo Alignment**

Drum Free-Running Speed Check (7-1-1)

↓

Pulse Symmetry Adjustment (7-1-2)

↓

Gate Pulse Lock Phase Adjustment (7-1-3)

↓

Lock Phase Adjustment (7-1-4)

↓

Servo Hunting Adjustment (7-1-5)

↓

Section 7-2 **Playback Mode Servo Alignment**

CTL Pulse Check (7-2-1)

↓

Tracking Control Calibration (7-2-2)

↓

PG Pulse Delay Time Adjustment (7-2-3)

↓

30 PG Coil Position Setting (7-2-4)

↓

30 PG Coil Dihedral Adjustment (7-2-5)

EQUIPMENT REQUIRED:

Digital Frequency Counter:	Hewlett Packard HP-5245-L, or equivalent
Oscilloscope:	Tektronix type 422, or equivalent
Monitor/receiver:	SONY CVM-1200UA, or equivalent
SONY Alignment Tape:	SONY Part No. 8-943-508-40

4-8. REEL TABLE HEIGHT

1. Run a tape in the FORWARD mode.
2. Check both reels to see that tape does not rub against the edges of the reels.
3. If the tape is not centered in either reel, adjust reel height by adding or removing the fiber washers (Thrust Bearing Washers, Part Number 3-005-074-51, 52, 53) beneath the Reel-Table Assembly.

4-9. AUDIO/CONTROL HEAD REPLACEMENT

A malfunctioning Audio/Control Head can be replaced without disturbing servo tracking by the following procedure.

1. Unsolder the leads at the rear of the Audio/Control Head.
2. Remove the screws labelled A and C in Fig. 4-10 (a). Be careful not to lose the spring on the left screw (A). Do not loosen the screws in the long slots.
3. Lift the head assembly off the mounting plate.
4. Remove the screws labelled B and D in Fig. 4-10 (a) and install the screws on the new head assembly.
5. Install the Head Mounting Plate Assembly using the original screws A and C in Fig. 4-10(a). The spring on screw A goes between the head of the screw and the top of the mounting plate. Tighten screw A and adjust screws B, C and D as follows.
6. Play the tape and check that the core of the head extends an equal amount above and below the edges of the tape. See Fig. 4-10(b). Adjust the height and tilt screws at the front and rear of the mounting assembly, if necessary, until this condition is achieved.
7. Thread the SONY Alignment Tape and play the 7 kHz section. Connect an AC VTVM to the LINE OUT connector on the Connector Panel and terminate this connector with a 10 kΩ resistor, Adjust the azimuth and tilt screws (Screws B and D in Fig. 4-10(a)) for maximum indication on the VTVM (maximum output at 7 kHz).
8. Check audio bias voltage. See Section 8-6.

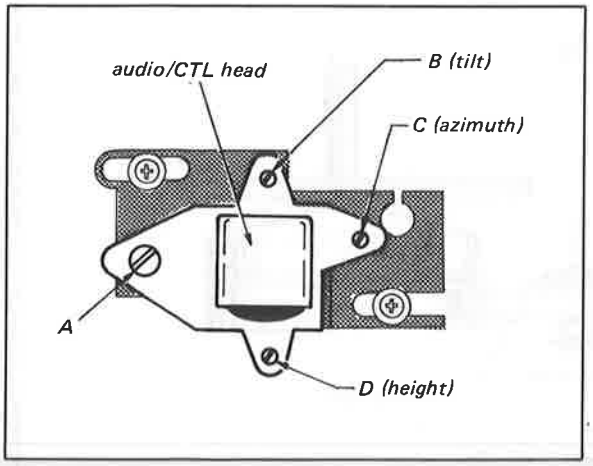
4-10. TAKE-UP IDLER ADJUSTMENT

Capstan Motor Pulley Height Check

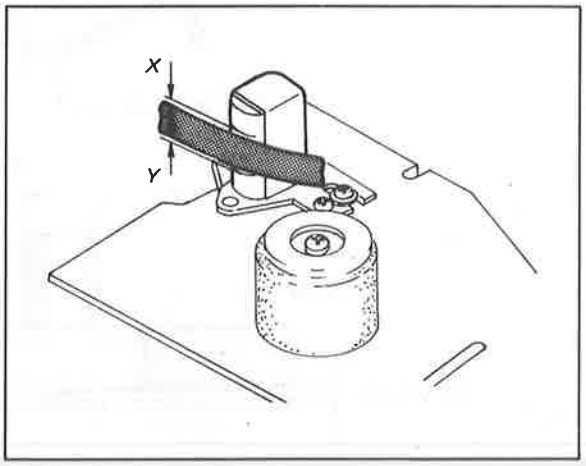
1. Make sure the Capstan Belt is clear of the Pause Brake Push Rod by 0.5 to 1 mm. See Fig. 4-11.
2. Check that the Capstan Motor Pulley is clear of the Take-Up Idler by more than 1 mm. See Fig. 4-11.
3. Adjust the height of the Capstan Motor Pulley, if necessary.

Take-Up Idler Height (Fast Forward Mode)

1. Set the Function Lever to the FAST FORWARD position. The Take-Up Idler is lifted by the Take-Up Cam. Make sure that the lower surfaces of the



(a)



(b)

Fig. 4-10. Audio/Control head replacement and adjustment

Take-Up Idler and the Take-Up Reel Table (upper) are in line or that the lower surface of the Take-Up Idler is slightly higher.

2. If this condition does not exist, place the Function Lever in the FORWARD position. Bend Finger A with a pair of pliers as shown in Fig. 4-12. to obtain the correct Take-Up Idler height.

4-11. REWIND IDLER REPLACEMENT

1. Check the Rewind Idlers if the machine is noisy or does not wind up tape smoothly and rapidly during rewind, or if the Supply Reel is not braked properly when going from FORWARD to STOP.
2. Inspect the driving surfaces of both Rewind Idlers for excessive or uneven wear. Inspect the driving surface of the Supply Reel Assembly. Clean away any oil or debris from all driving surfaces.
3. Set the Function Lever to STOP. Check that the Right Rewind Idler is clear of the Idler Stopper by 0.5 to 1 mm. See Fig. 4-13. If this condition does not exist, bend the Idler Stopper with a pair of pliers.
4. Check that the contacting surfaces of the Right and Left Rewind Idlers are parallel. If they are not, bend them by hand.
5. Set the Function Lever to STOP. Check that the Supply Reel Table, Left Rewind Idler, and Right Rewind Idler are contacting securely. Make sure at this time that the Right Rewind Idler is disengaged from the Take-Up Reel Table by more than 1 mm. See Fig. 4-13. To replace the Rewind Idlers proceed as follows.
6. Set the Function Lever to FORWARD. Pry the Retaining Ring (E5) from the top of the Left Rewind Idler shaft using a screwdriver. Remove the fiber washer. Lift the Left Rewind Idler off its shaft.

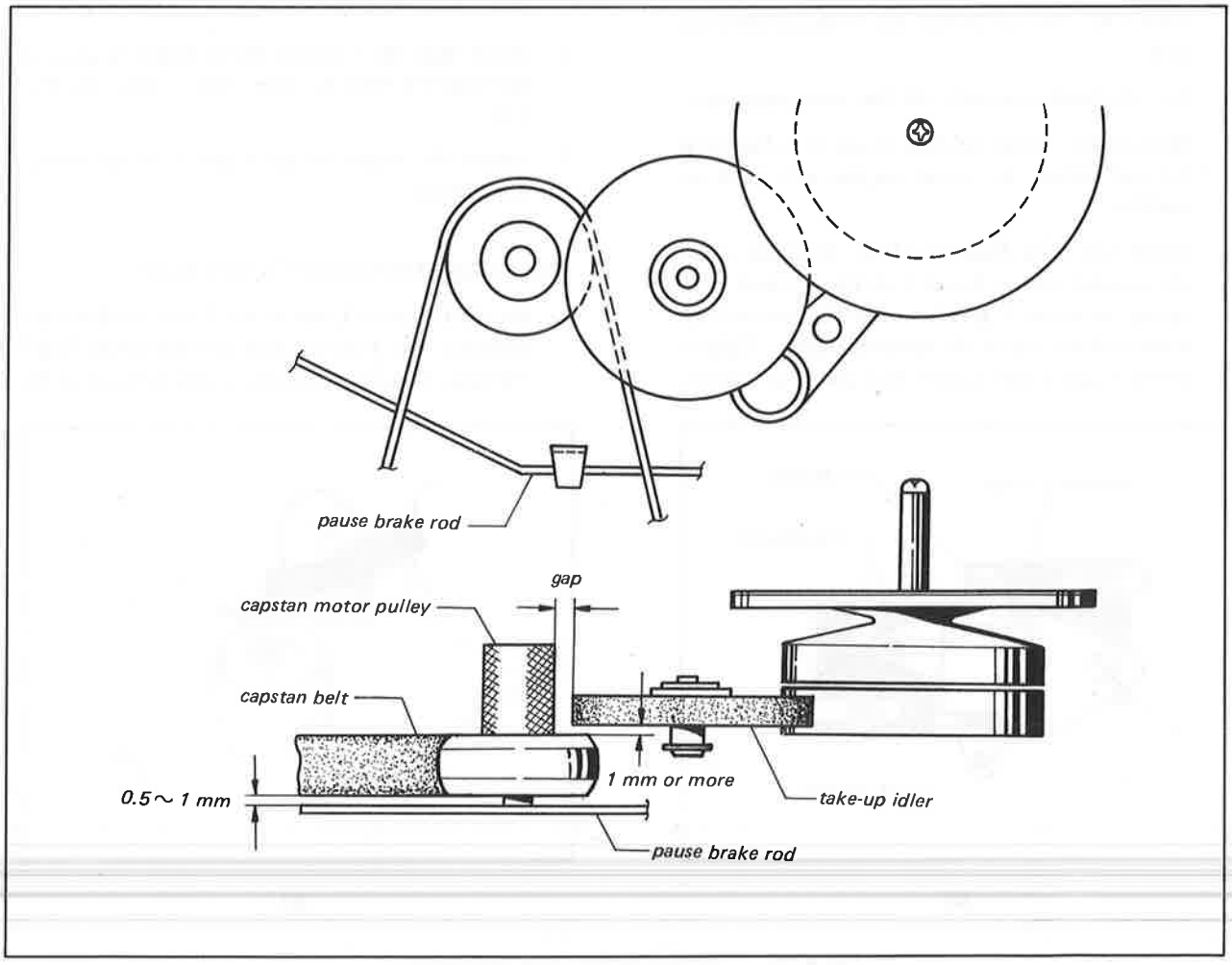


Fig. 4-11. Capstan motor pulley height

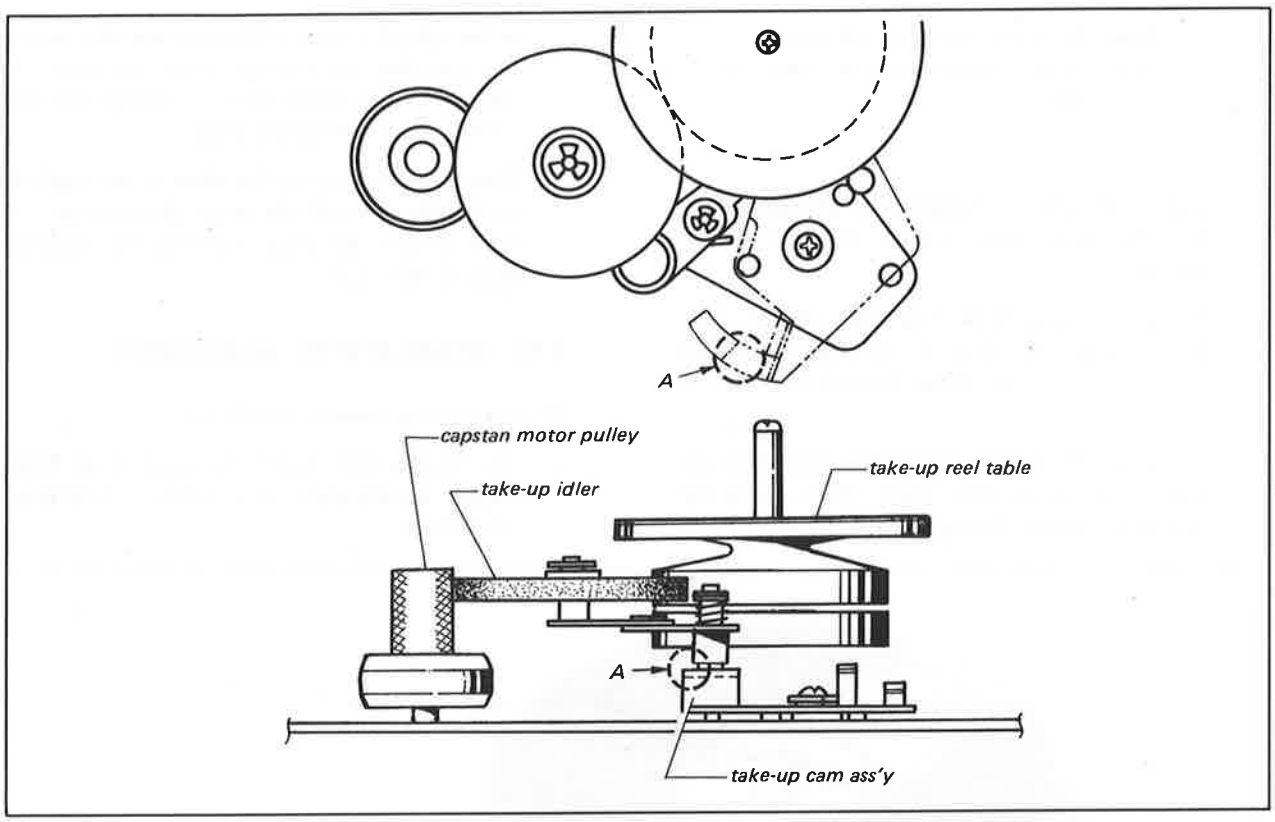


Fig. 4-12. Take-up idler height

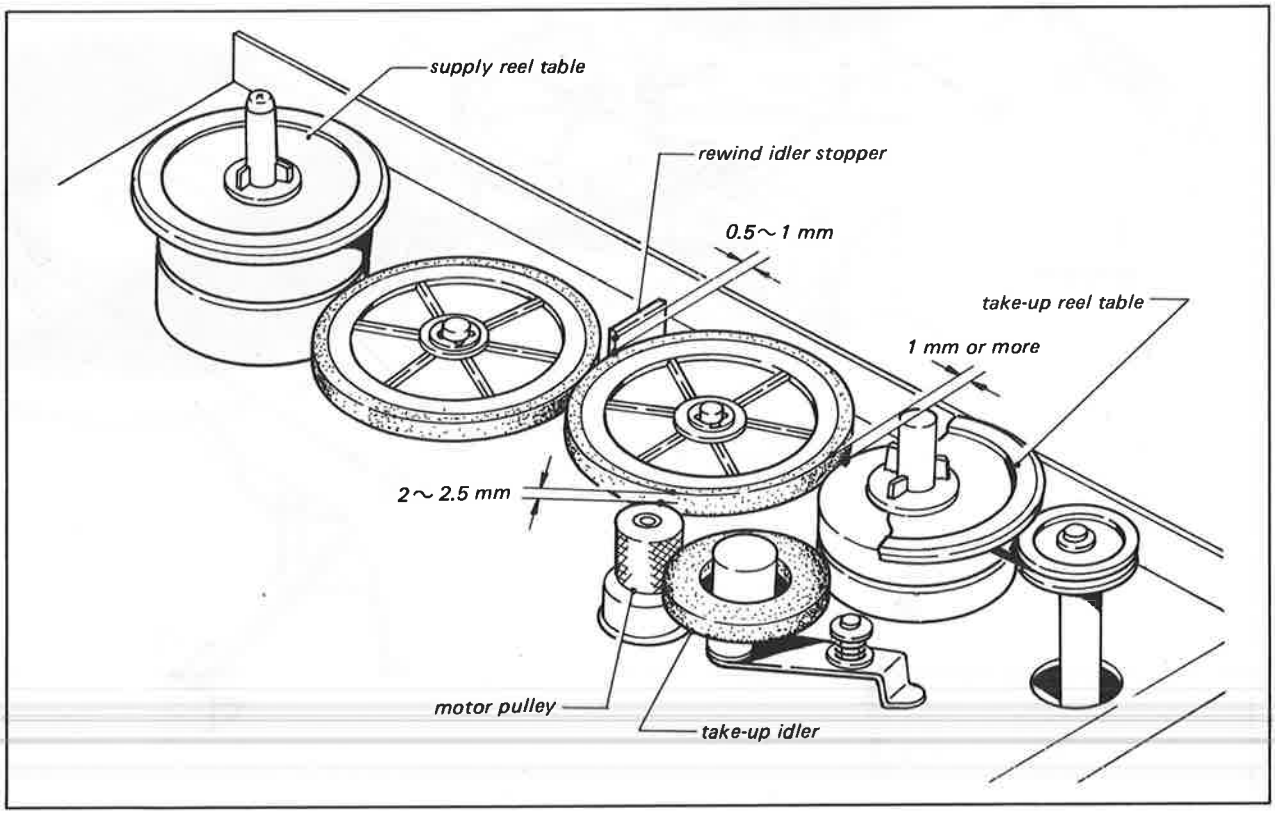


Fig. 4-13. Rewind idler replacement

Note: The directional brake will spring back counterclockwise when the idler is removed.

7. Inspect the idler to identify top and bottom so that the replacement will be installed correct side up.

8. Pry the Retaining Ring (E5) from the top of the Right Rewind Idler. Remove the fiber washer and push rod. Lift the Right Rewind Idler off its shaft.

9. To replace the Left Rewind Idler, first place one drop of oil on the idler shaft. Next, rotate the directional brake clockwise until the point faces to the right (3 o'clock). Position the idler shaft so that the idler can be dropped onto the shaft. Release the directional brake. Install the fiber washer and the Retaining Ring.

10. Place a drop of oil on the shaft of the Right Rewind Idler. Install the Right Rewind Idler, the fiber washer, the push rod, and the Retaining Ring in that order.

4-12. BRAKE-SYSTEM ADJUSTMENT

System braking requires attention if:

a. The Supply Reel exerts too much back tension during FORWARD and FAST FORWARD operations.

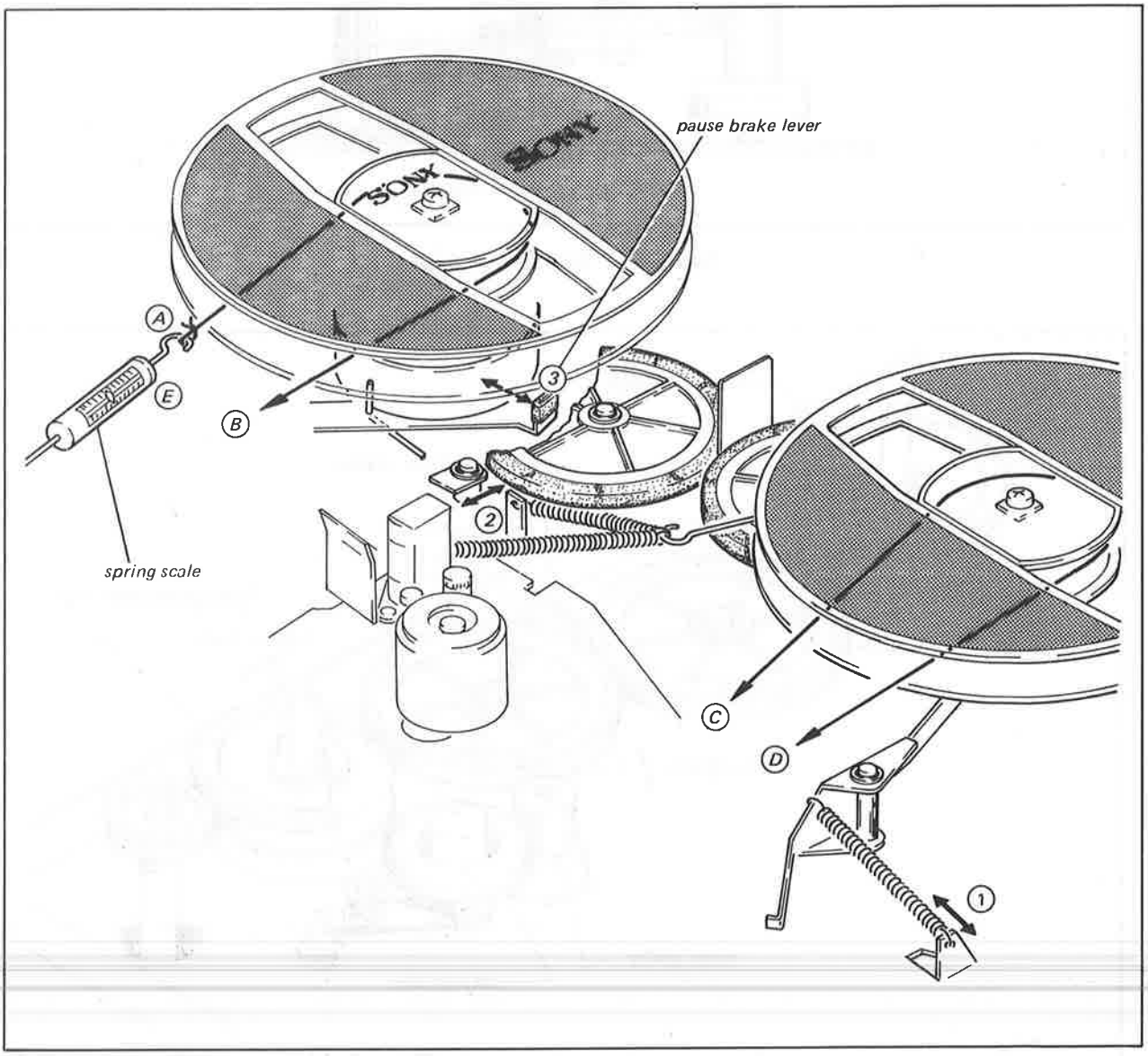


Fig. 4-14. Brake torque adjustment

b. The Supply Reel pays out and slackens tape when going from FORWARD or FAST FORWARD to STOP.

c. The Take-Up Reel exerts too much back tension during Rewind.

d. The Take-Up Reel pays out too much tape when going from REWIND to STOP.

e. The Supply Reel rotates during Pause operation.

Brake Torque Adjustment

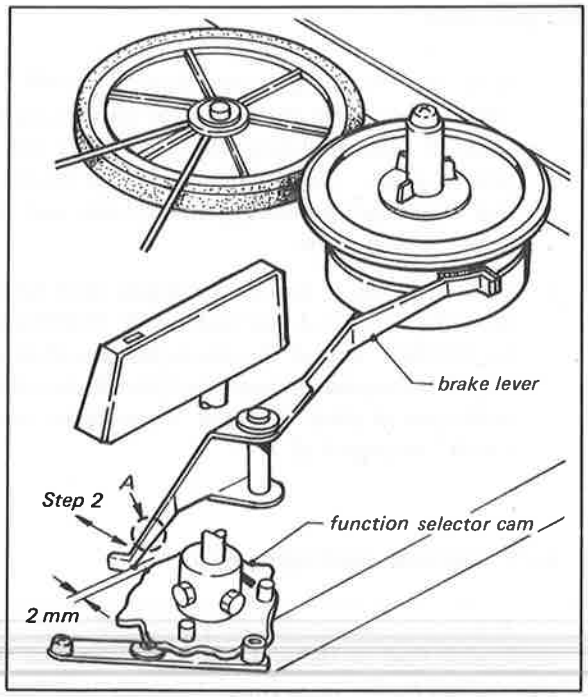
1. Set the Function Lever to STOP.
2. Place an empty reel (RH-7V) with several turns of string wrapped around the hub onto the Supply Reel Table as shown in Fig. 4-14. Tie the reel to the spring scale. Pull the scale at a speed of approximately 4 inches/sec. Check the reading for brake torque. It should be more than 800 g-cm.
3. Repeat the above brake-torque checks for Ⓑ, Ⓒ and Ⓓ as indicated in Fig. 4-14. The brake torques should be less than 400 g-cm for the direction of Ⓑ, less than 450 g-cm for the direction of Ⓒ and more than 800 g-cm for the direction of Ⓓ.
4. Bend Spring Supporting Brackets ① and ② with a pair of pliers, if necessary, to obtain the correct brake torques.
5. Set the Function Lever to PAUSE.
6. Repeat the procedure described in Step 2 for the direction indicated by Ⓔ in Fig. 4-14. It should be more than 1,000 g-cm.
7. If necessary, bend the portion of the Pause Brake Lever identified by ③ with a pair of pliers.

Take-Up Brake Lever Check

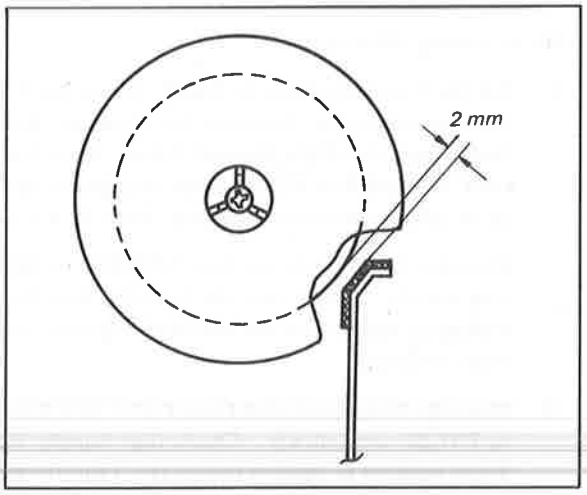
1. Set the Function Lever to STOP.
2. Check that the top end of the Brake Lever is disengaged from the Function Selector Cam by approximately 2 mm. Refer to Fig. 4-15(a).
3. Set the Function Lever to REWIND.
4. Check for a clearance of approximately 2 mm between the Brake Lever and the Take-Up Reel Table.
5. If necessary, bend the portion of the Brake Lever identified by "A" with a pair of pliers.

Pause Brake Lever Check

1. Set the Function Lever to REWIND.
2. Check for a clearance of approximately 1 mm between the Pause Brake Lever and the Supply Reel Table.
3. If this condition does not exist, turn nut "A" shown in Fig. 4-16.
4. Advance the tape. Check that the tape stops running in the PAUSE mode.
5. In the PAUSE mode, check for play between the Brake Lever and the nut.



(a) STOP mode



(b) REWIND mode

Fig. 4-15. Take-up brake lever check

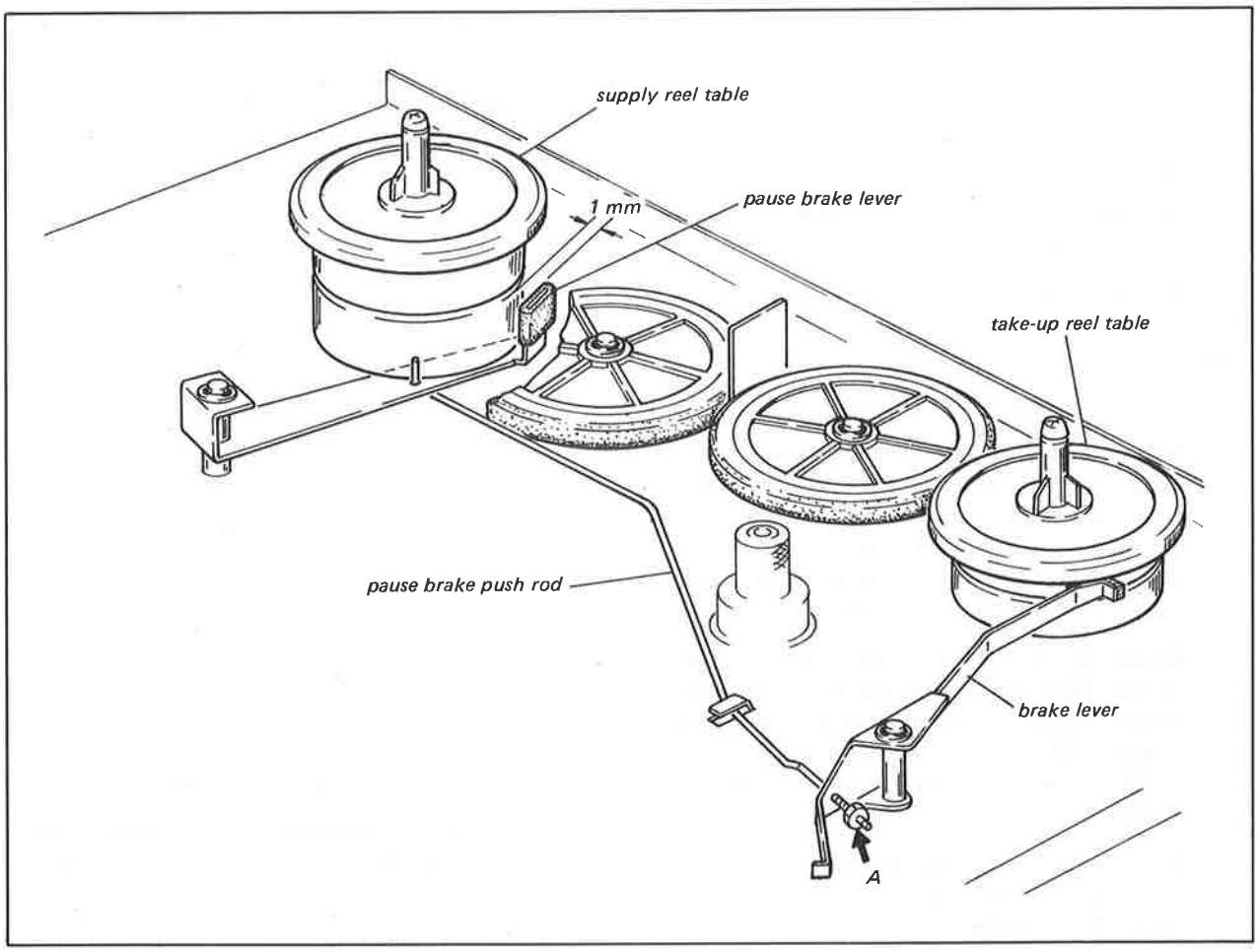


Fig. 4-16. Pause brake lever check

6. Place the Function Lever in all the modes except PAUSE. Check for clearance between the Pause Brake Lever and the Supply Reel Table. The clearance should be more than 0.5 mm.

Brake Timing Adjustment

1. Set the Function Lever to STOP. Check for a 2-2.5 mm clearance between the Capstan Motor Pulley and the Right Rewind Idler. Bend Take-Up Cam Push Rod A with a pair of pliers as needed to obtain the correct spacing. See Fig. 4-17.
2. Move the Function Lever from REWIND to STOP very slowly. Check that the Take-Up Reel Table braking is applied before the Right Rewind Idler stops rotating.
3. Move the Function Lever from FAST FORWARD to PAUSE very slowly. Check that Supply Reel Table braking is applied before the Take-Up Reel Table stops running.
4. Thread a tape on the VTR and advance it until all the tape is on the Take-Up Reel Table. Move the Function Lever from REWIND to STOP. Check that the tape stops without excess slack. If it does not, bend the Brake Lever with a pair of pliers. There should still be at least 0.5 mm clearance between the Brake Lever and the Take-Up Reel Table.
5. Place a full reel of tape on the Supply Reel Table. Move the Function Lever from FAST FORWARD to PAUSE. Repeat the procedure described in Step 4. If necessary, bend the Pause Brake Lever with a pair of pliers. Refer to "Pause Brake Lever Check" on page 4-12.

4-13. MOTOR REPLACEMENT

If the motor is suspected to be defective, check the mechanical load on the motor to make sure that the Capstan and Rotary Head Drum Assembly turn freely. Check for line voltage between the black and white leads of the motor (set the Function Lever to FORWARD). Also check phasing capacitor C001 in

series with the green lead of the motor. If line voltage is present and the phasing circuit is correct, but the motor does not turn, replace the motor as follows.

1. Stand the machine on its left side.
2. Cut the white and black motor leads at the terminal strip. Cut the green motor lead at the terminal of phasing capacitor C001. Leave 1/8″ insulation on the stubs of the leads remaining on the terminal strip and the phasing capacitor. The colored insulation will aid in locating the correct tie points for the new motor.
3. Remove the drive belt for the Rotary Head Drum Assembly.
4. Inspect the lower drive pulley on the motor shaft and note the position of the fan on the shaft. The bottom of the fan hub should be almost flush with the lower end of the motor shaft.
5. Loosen the set screw in the lower drive pulley and remove the drive pulley and fan.

   Note: Do not remove the gray plastic fan from the lower drive pulley.

6. Set the Function Lever to PAUSE. Hold the motor with one hand and back out the four Phillips-head screws from the top of the chassis.

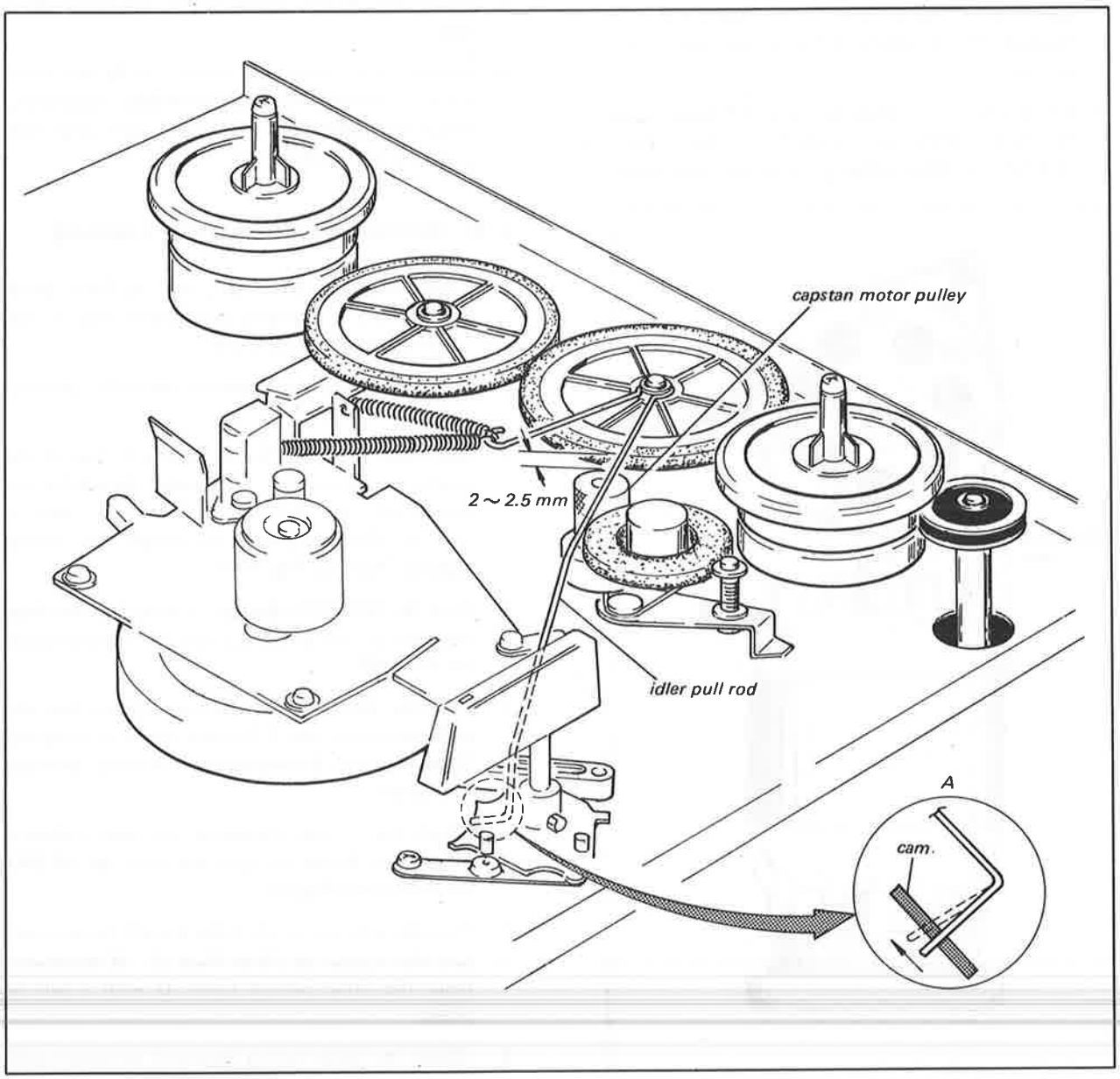


Fig. 4-17. Brake timing adjustment

7. Remove the upper (knurled) drive pulley (Capstan Pulley) from the top of the motor shaft.

8. Note the position of the hum belt (the steel band that surrounds the motor). Loosen the two screws that apply tension to the hum belt and remove the belt.

9. Install the hum belt on the new motor. Position the mounting screws as shown in Fig. 4-18. Make sure that the hum belt straddles the two end bells equally.

10. Install the top (knurled) drive pulley on the upper motor shaft. Space the bottom edge of the pulley about 4 mm from the top of the motor.

11. Insert the screws with spring washers (PS 4 x 8) through the mounting holes at the top of the chassis.

12. Put the motor in place beneath the chassis with the leads coming out toward the bracket. Make sure that the upper pulley is inside the loop of the capstan drive belt. Thread the screws installed in Step 11 into the motor end bell.

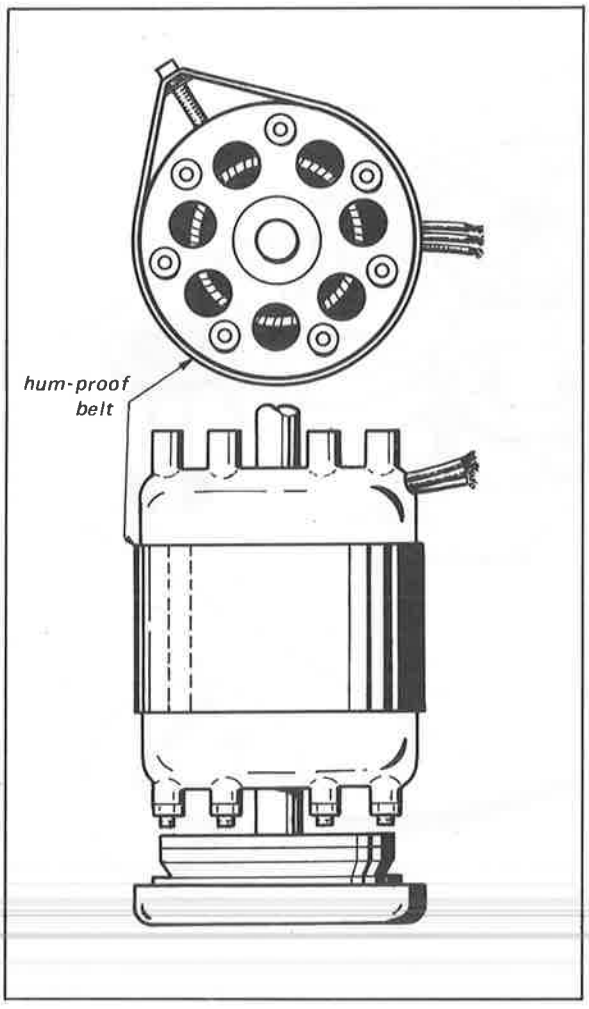


Fig. 4-18. Installation of the motor hum belt

13. Tighten all screws.

14. Check the Capstan Drive Belt to make sure it is placed properly on the Flywheel.

15. Install the lower drive pulley. Refer to Step 4 for the proper position.

16. Slide the plastic sleeve over the motor leads. Solder the motor leads to the following tie points.
    black ..... grounding lug of C001
    white ..... terminal 5 of the terminal strip
    green ..... 2.5 μF lug of C001

17. Install the Rotary Head Drum Assembly drive belt.

18. Operate the motor and check the FORWARD, FAST FORWARD, and REWIND operations. Check the running position of the lower drive belt as directed in Section 4-4.

4-14. RECORD BUTTON LATCH LINKAGE

1. Check that the RECORD and AUDIO DUB buttons can be pushed and locked only in the STOP and the PAUSE modes.

2. If the latch does not operate correctly, proceed as follows.

3. Make sure that the Record Button is clear of the Audio Set Lock Bar. Clearance should be between 0.1 and 0.3 mm. Bend "A" with a pair of pliers as needed to obtain the correct spacing. Refer to Fig. 4-19.

4. Push the RECORD Button. Check that the slide switches on the VM1, A2, and SV circuit boards are actuated.

5. Push the AUDIO DUB Button. Check that the slide switch on the A2 circuit board is actuated. If the switches do not operate correctly, proceed as follows.

6. Check for 2 mm clearance (or less) between Slide Plate B and the split nut with the AUDIO DUB Button released.

7. Turn the split nut of the Slide Switch Lever to adjust the stroke of Slide Plate C. If necessary, bend the Slide Switch Lever D with a pair of pliers.

8. Adjust the Slide Switch Springs if necessary until the clearance between the ends of the slide switches on VM1, A2, and SV, circuit boards and

the Slide Switch Springs E, F, and C is approximately 1 mm. The Slide Switch Springs are wire leaf-type springs.

9. Actuate and release the RECORD and AUDIO DUB Buttons a few times. Check that the slide switches operate correctly.

4-15. AUTOMATIC SHUTOFF SWITCH ADJUSTMENT

To check the operation of the Automatic Shut-Off Switch, turn on the power and proceed as follows.

1. Remove the tape from the normal tape path. Set the Function Lever first to FORWARD, then to PAUSE, FAST FORWARD, and REWIND. The motor should shut off in each position after about 1 second. Repeat this check with tape threaded properly. The motor should remain on when the Function Lever is set to FORWARD, PAUSE, FAST FORWARD, and REWIND.
2. Set the Function Lever to STOP, and depress the RECORD button. The motor should turn on.
3. Thread the tape on the VTR. Make sure that the motor is not shut off by a slight overshoot of the tape sensing wire. If the aforementioned conditions are not met, proceed to the following steps.
4. Set the Function Lever to STOP. Check for approximately 4 mm or more clearance between the tape surface and the sensing wire.
   If not, bend Section "A" of the sensing wire with a pair of pliers or turn the split nut at "B" shown in Fig. 4-20.

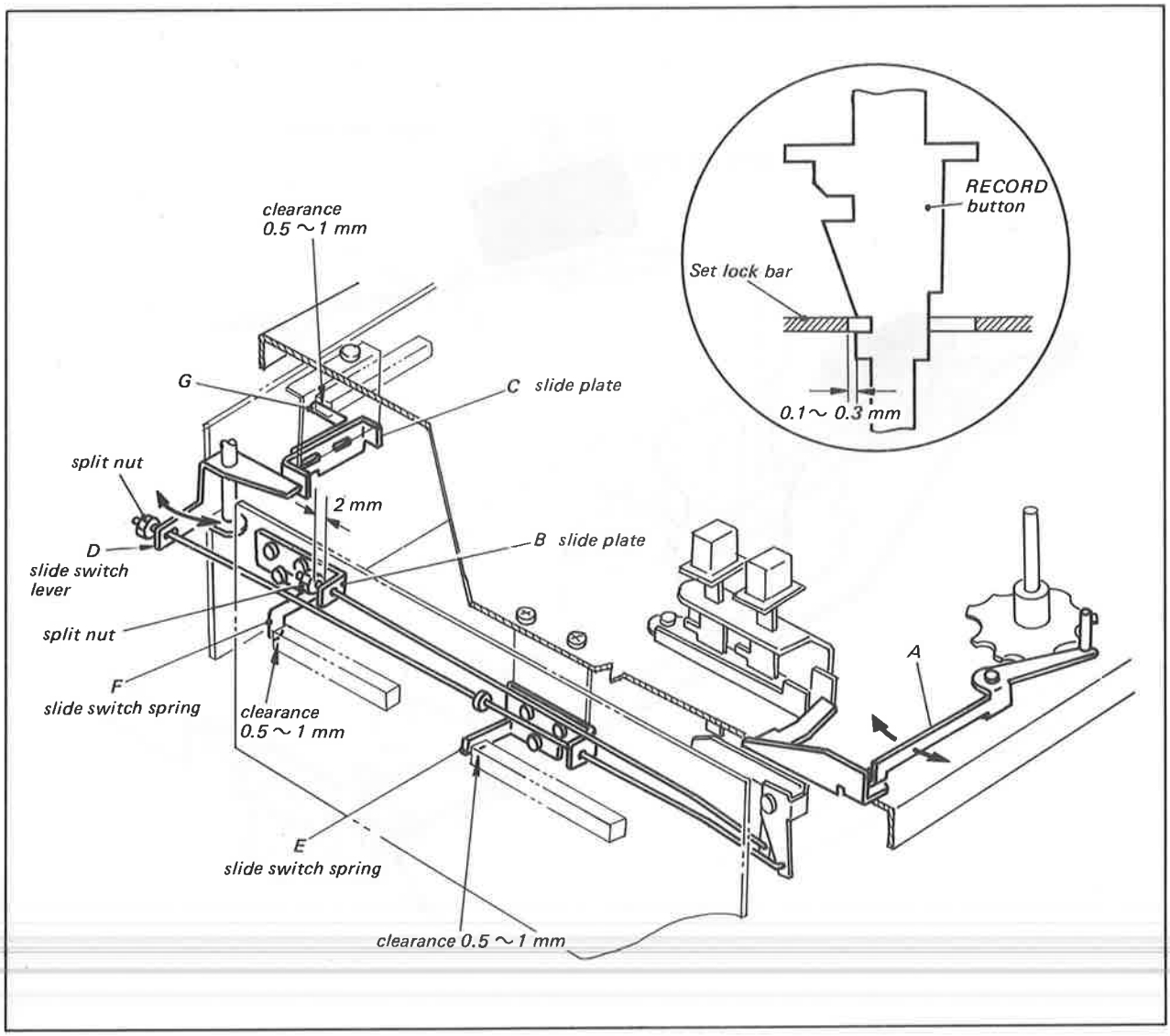


Fig. 4-19. RECORD button latching mechanism and adjustment

5. Set the Function Lever to the REWIND mode. Check that the microswitch turns off before the sensing wire is more than 3 mm beyond the tape running surface. If not, reposition the microswitch as follows:

6. Loosen the two screws that secure the microswitch to the mounting bracket or the two screws that fasten the mounting bracket to the chassis. Slide the bracket or microswitch to obtain the correct condition. See Fig. 4-20.

7. Make sure that the microswitch turns off the motor correctly in each mode.

8. Make sure that the sensing wire operates smoothly without touching the Tape Guide or the Tapered Guide.

4-16. CAPSTAN BEARING AND SHAFT REPLACEMENT

A worn Capstan Bearing results in noisy operation (a squealing sound from the capstan). When it becomes necessary to replace the Capstan Bearing, the Capstan Shaft (assembly including the Flywheel) must be replaced as well.

Proceed as follows.

1. Remove the Reel Panel.

2. Remove the screw securing the Capstan and pry off the Capstan.

3. Remove the retaining washer holding the Pull Rod to the Right Rewind Idler Shaft. Remove The Pull Rod from the Idler Shaft.

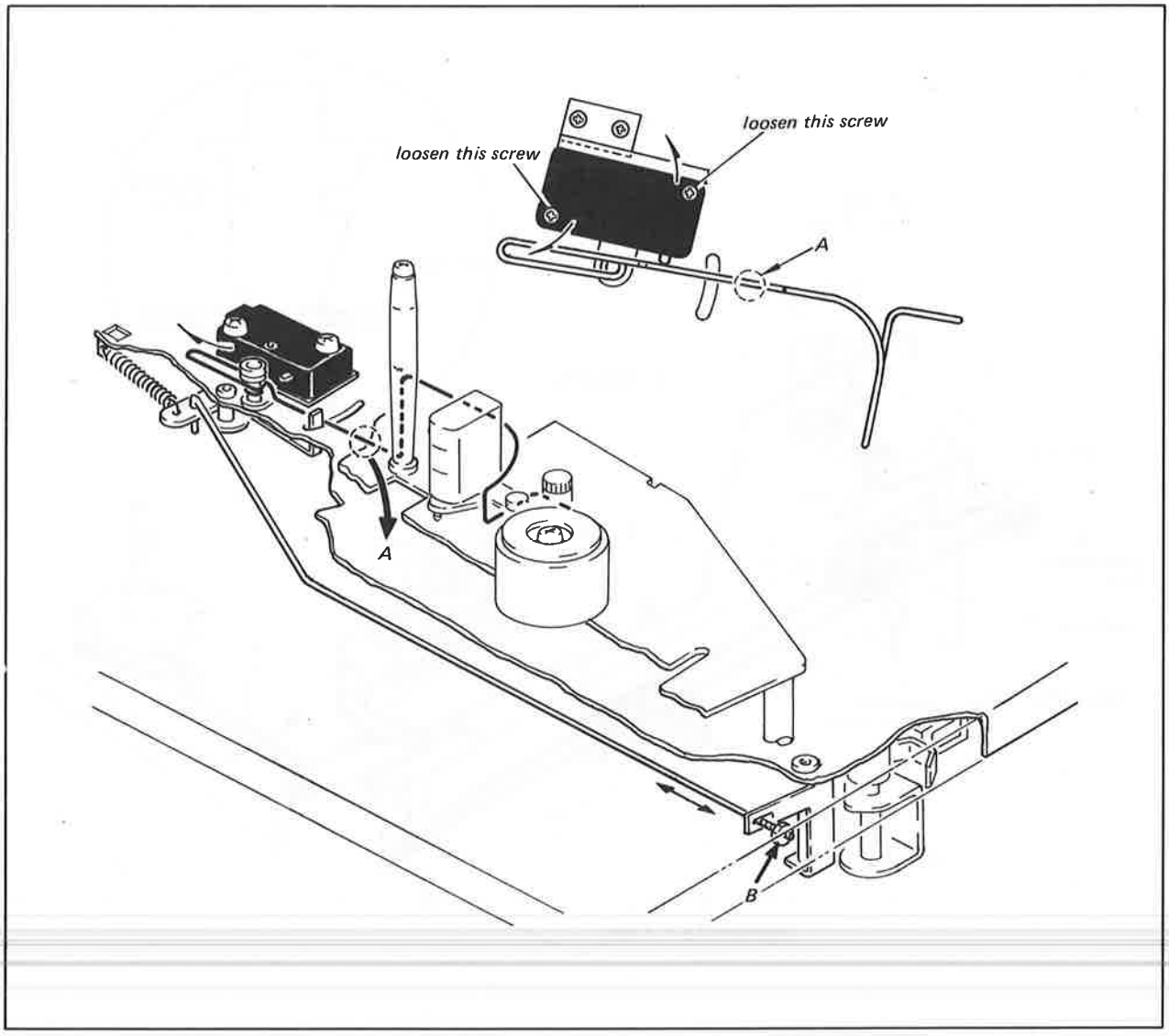


Fig. 4-20. Automatic shutoff switch adjustment

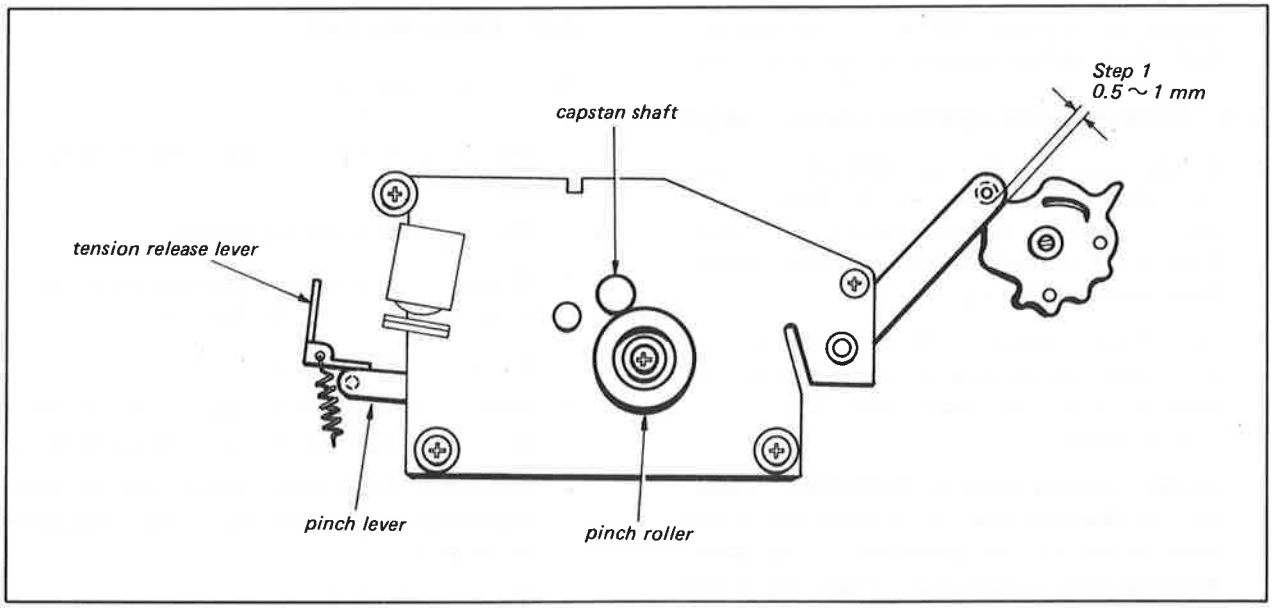


Fig. 4-21. Capstan deck adjustment

4. Remove the two springs from the Rewind Idler Push Rod.
5. Remove the four screws securing the Capstan Deck Ass'y to the support on the chassis.
6. Lift up the Capstan Deck Ass'y. Take the drive belt off the Flywheel.
7. Pull the Capstan Shaft Ass'y (Flywheel) off the Capstan Bearing on the Capstan Deck.
8. Fold the Capstan Deck Ass'y back and remove the Capstan Bearing Retainer by removing the three screws.
9. Remove the Capstan Bearing Cap from the Capstan Bearing Oil Ring and Oil Ring Retainer using a pair of pliers. Remove the Capstan Bearing.
10. Before installing the new Capstan Bearing inspect the replacement. Pass a clean lint-free cloth through the capstan hole, and inspect the inner surfaces for dirt or foreign matter.
11. Inspect the new Capstan Shaft Assembly. Handle the Capstan Shaft carefully to avoid scratches or nicks on the bearing surface.
12. Insert the Capstan Bearing into the Capstan Deck and put the Capstan Bearing Retainer on the Capstan Bearing. Tighten the three screws that secure the retainer to the chassis.
13. Place a few drops of oil on the inner surface of the bearing.
14. Put the Spacer on the Capstan Shaft. Insert the shaft into the Capstan Bearing.
15. Hold the Flywheel with one hand and slip the Oil Ring Retainer and Oil Ring onto the shaft. Place a few drops of oil on the Oil Ring, then install the Bearing Cap on the Capstan Bearing.
16. Reinstall the capstan drive belt. Install the new Capstan and replace the mounting screw.
17. Put the Capstan Deck Assembly with Flywheel on the four posts of the chassis. Position the Pinch Lever with relation to Tension Release Lever as shown in Fig. 4-21.
18. Tighten the four screws that secure the Capstan Deck Assembly to the capstan deck supports.
19. Reconnect the Pull Rod Spring to the Pull Rod.
20. Install the Pull Rod and retainer onto the Rewind Idler Shaft.

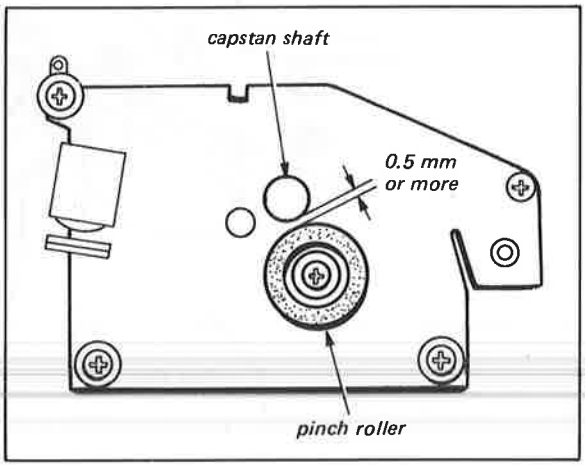


Fig. 4-22. Capstan deck adjustment

21. Operate the machine. Check servo tracking and Audio/Control Head Adjustment. See Section 4-8.

4-17. CAPSTAN DECK ASSEMBLY ADJUSTMENT

1. Set the Function Lever to FORWARD. Check that the clearance between the Pinch Lever and the Function Selector Cam is 0.5 to 1 mm. If necessary, readjust the position of the Capstan Deck Assembly. See Fig. 4-21.
2. Set the Function Lever to PAUSE. Make sure that the clearance between the Capstan Shaft and the Pinch Roller is more than 0.5 mm. If necessary, recheck Step 1.
3. Set the Function Lever to FORWARD. Check that the clearance between the upper end of the Pinch Lever and the lower end of the Drum Mounting Deck is more than 1.5 mm. See Fig. 4-23. If it needs adjustment, bend "A" in Fig. 4-23, with a pair of pliers. Recheck Pinch Roller Pressure as described in Section 4-18.
4. Switch the Function Lever through all modes. Check the tape motion.

4-18. PINCH ROLLER

Pinch Roller Replacement

Replace a worn or damaged Pinch Roller as follows.

1. Place the VTR in the STOP mode.
2. Remove the Pinch Roller Retainer and mounting screw from the top of the Pinch Roller.
3. Lift off the Pinch Roller.
4. Remove the Pinch Roller Spacer and the Pinch Roller Oil Ring from the top of the Pinch Roller.
5. Install the Pinch Roller Spacer and the Pinch Roller Oil Ring on the top of the replacement Pinch Roller.
6. Place the Pinch Roller Assembly on the Pinch Roller Shaft.
7. Install the Pinch Roller Retainer and mounting screw.
8. Test the Pinch Roller to see that it spins freely.

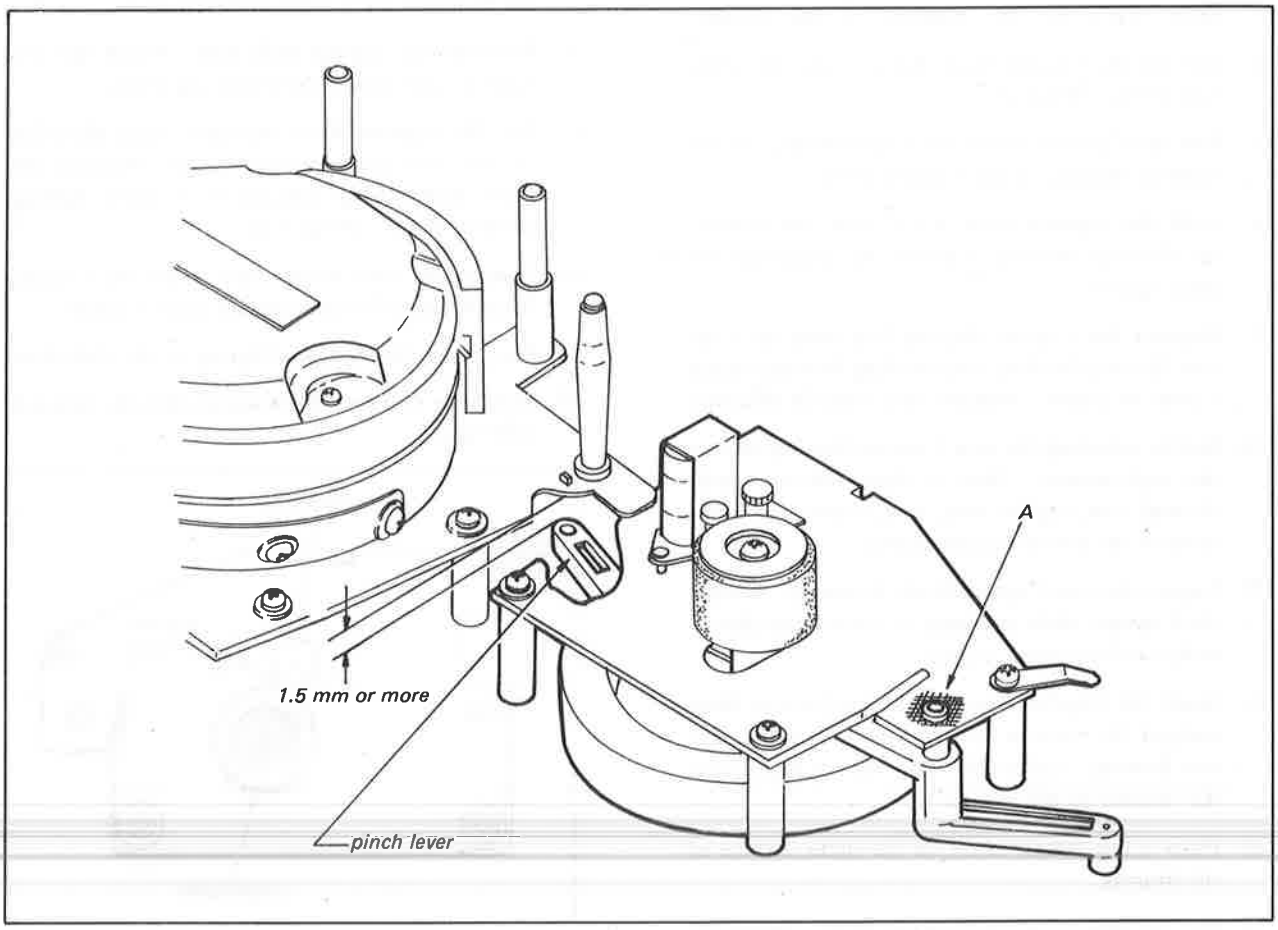


Fig. 4-23. Pinch lever adjustment

Pinch Roller Pressure Adjustment

1. Set the Function Lever to FORWARD. Check for 0.1 mm clearance between the lower end of the Pinch Roller and the Capstan Shaft when the upper end of the Pinch Roller contacts the Capstan Shaft. See Fig. 4-24. Bend "A" in Fig. 4-23 with a pair of pliers as needed to obtain the correct spacing.

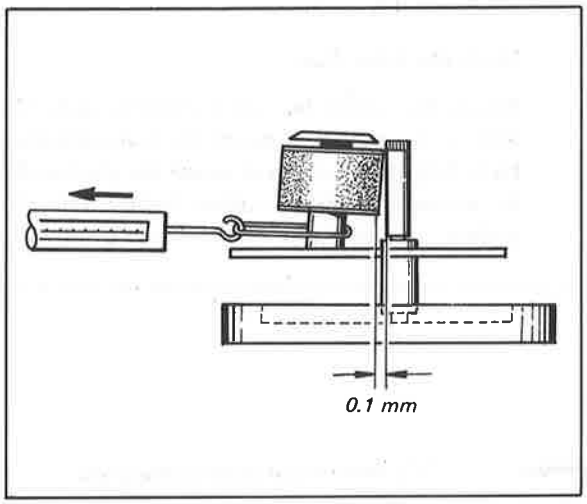


Fig. 4-24. Pinch roller adjustment

2. Place the Function Lever in the FORWARD position. Make a loop in a piece of string and attach the spring scale around the base of the Pinch Roller Shaft. See Fig. 4-24. Pull the scale in the direction indicated by the arrow. Check the reading when the Pinch Roller just leaves the Capstan Shaft. It should be between 1.5 and 2.2 kg.

4-19. MICROSWITCH MAINTENANCE AND ADJUSTMENT

1. Set the Function Lever to the STOP mode. Make sure that the switching button of the microswitch (SW3, under the chassis, beneath the Function Lever) is in the center of the cam. See Fig. 4-25. Note, the microswitch (SW3) turns off with the pushbutton pressed.
2. If it does not operate normally, loosen the mounting screw and readjust the position of the Microswitch Assembly within the slot of the Microswitch Mounting Bracket. After adjustment, apply a suitable locking compound to the mounting screw.
3. Coat the cam contacting surface with grease.

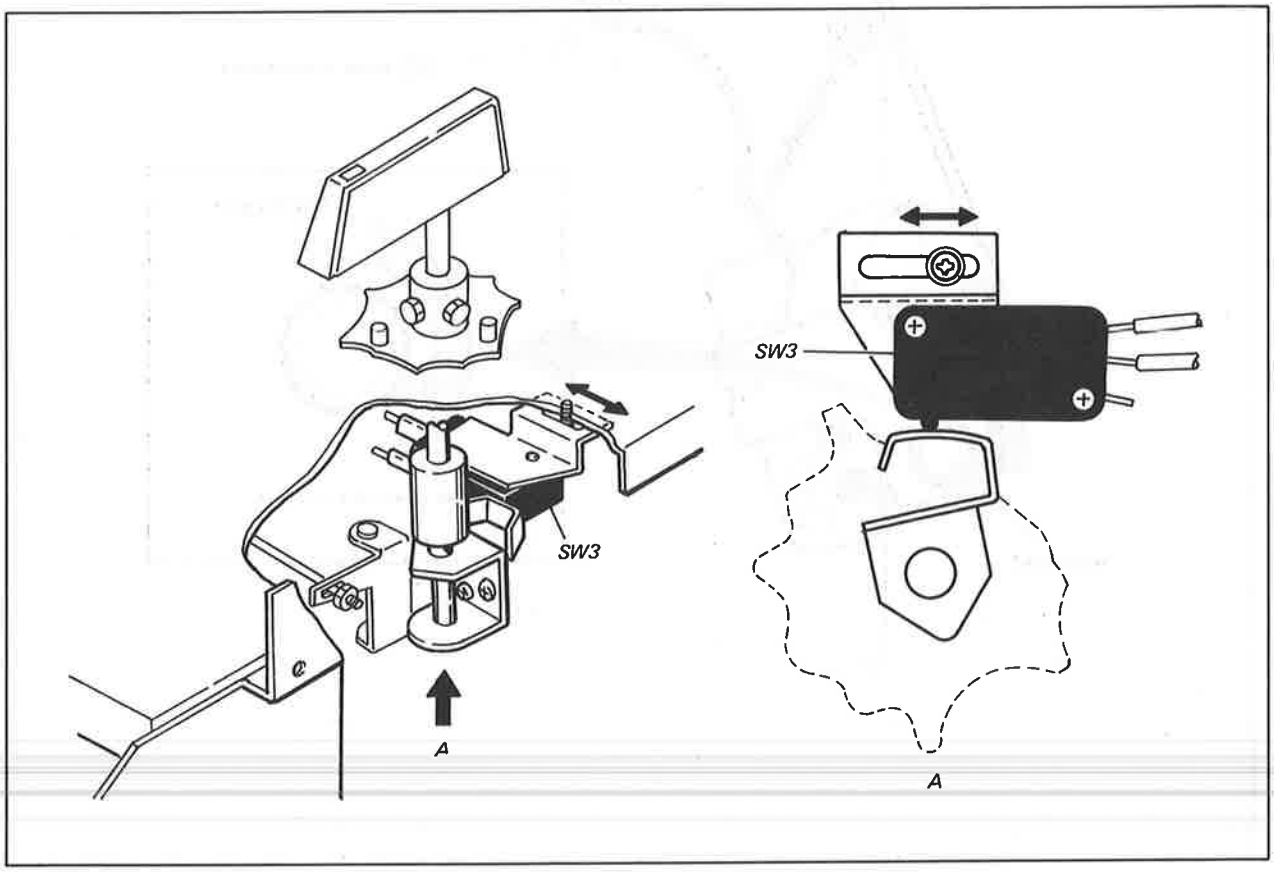


Fig. 4-25. Microswitch adjustment

4-20. SKEW CONTROL MECHANISM ADJUSTMENT

1. Check that the SKEW control knob maintains its position when turning it clockwise or counter-clockwise in the STOP mode.
2. Check that the Skew Control Lever (② in Fig. 4-26) stops Skew Control Clutch Assembly (①in Fig. 4-26) when the RECORD button is pressed and that the SKEW control knob returns to its normal position.
3. If the SKEW control knob does not return, bend Part A of the Skew Control Clutch Assembly toward the left in order to obtain 0.5 ~ 1 mm clearance between the clutch assembly and the knurled gear on the SKEW control shaft.

4-21. BELT SEPARATOR AND STATIC DISCHARGE PLATE ADJUSTMENTS

1. Belt Separator

   The Belt Separator should be situated so that in its free-standing position it fits naturally between the belt surfaces at the crossover point. See Fig. 4-27(a). Bend the Belt Separator Bracket to achieve this condition.

2. Static Discharge Plate

   Rotate the motor fan a few times to center the belt on the pulleys. Loosen the Static Discharge Plate Adjusting Screw and adjust the plate so that its extruded convex surface lightly rides the middle of the drum belt. See Fig. 4-27(b).

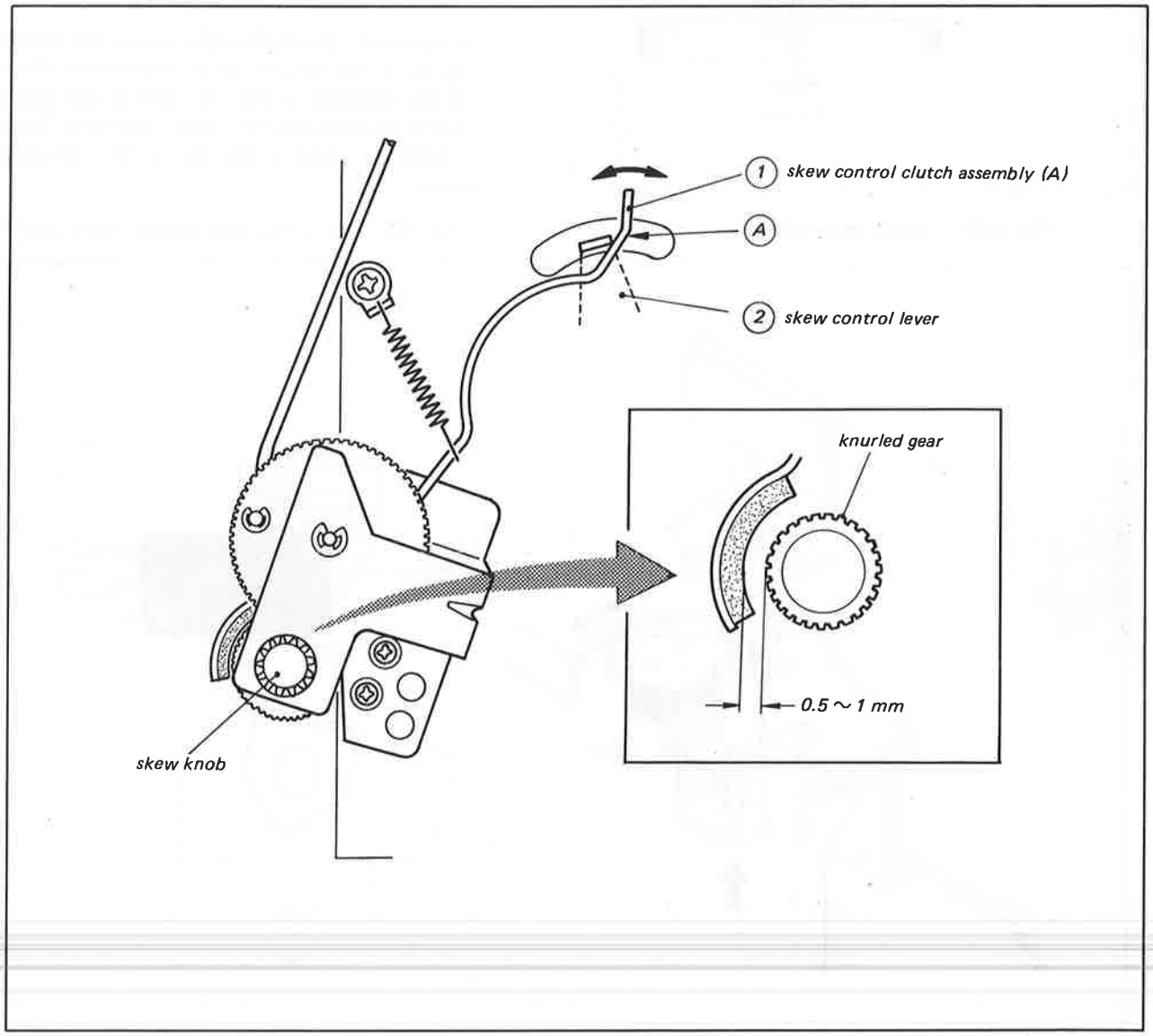


Fig. 4-26. Skew control mechanism adjustment

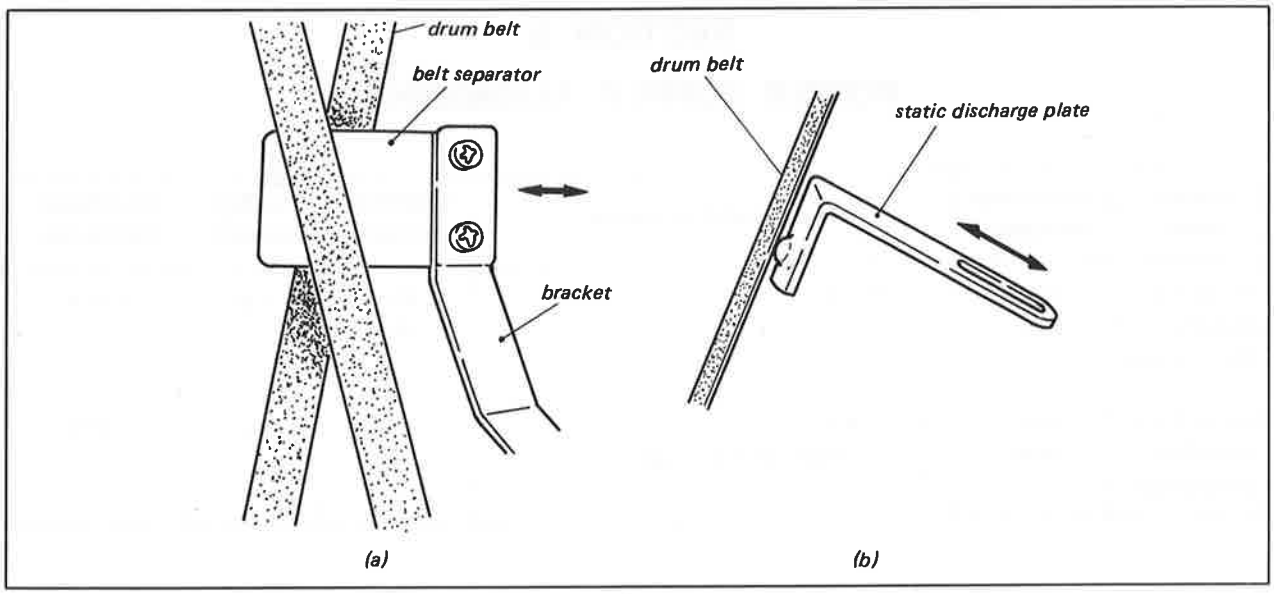


Fig. 4-27. Belt separator and static discharge plate

SECTION 5

POWER SUPPLY ALIGNMENT

	ADJUSTMENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
5-1	+B, 28 V d-c Regulated Power Supply	TP-601 (R4)	+28 V d-c	R604 (R4)	none	VTVM
5-2	+B, 10 V d-c Regulated Power Supply	TP-602 (R4)	+10 V d-c (first check +28 V d-c supply)	R610 (R4)	none	VTVM

SECTION 6
VIDEO SYSTEM ALIGNMENT

The video system alignment is divided into two procedures: Section 6-1 Luminance Signal Alignment and Section 6-2 Color Signal Alignment.

EQUIPMENT REQUIREMENTS

a. Color Receiver/
Monitor: SONY CVM-1200UA, or equivalent

b. Oscilloscope: Tektronix type 422, or equivalent

c. NTSC Color
Bar Generator: Cohu 2612 – 220, or equivalent

d. Digital Frequency
Counter: Hewlett Packard HP-5245-L, or equivalent

e. SONY Alignment Tapes
i. B/W Alignment
Tape: SONY Part No. 8-943-508-40
Contents: stairstep (5 min.), flying spot signal (3 min.), r-f sweep (3 min.), 1 kHz (5 min.), 7 kHz (6 min.).
ii. Color Alignment
Tape: SONY Part No. 8-943-508-20
Contents: color bars (6 min.), flying spot signal (4 min.), 1 kHz (6 min.), 7 kHz (4 min.).

f. (Not required but useful in precise set-up of record current)
Video Sweep Signal
Generator: Hewlett Packard 3300A with 3305A plug-in.

g. Alignment Tool: SONY Part No. 7-700-733-01

COLOR-BAR SIGNAL

Fig. 6-1 shows the 100 % color-bar signal of the Sony Color Alignment Tape, obtained at the VIDEO OUT connector. The color system alignment in Section 6-2 presumes that NTSC input color bar signal has the specifications as shown in Fig. 6-1.

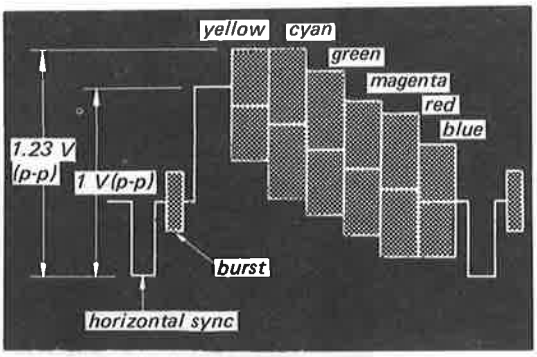
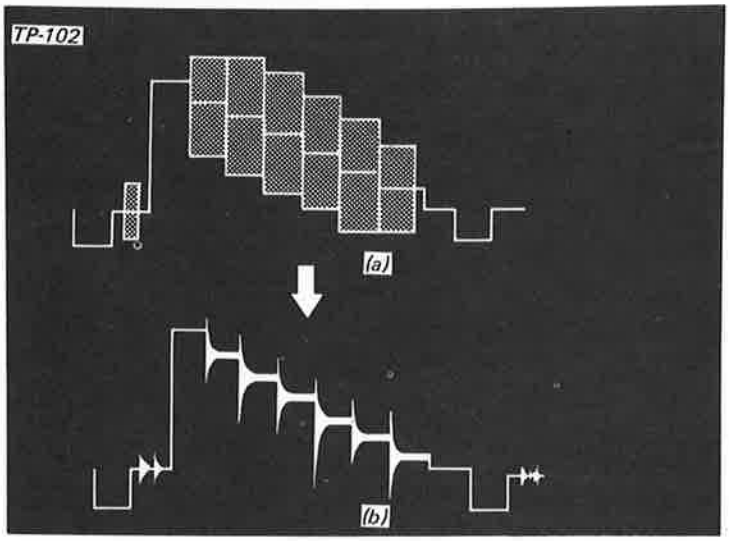


Fig. 6-1.

6-1. LUMINANCE SIGNAL ALIGNMENT

The luminance signal alignment procedure and sequence are shown below.

Subcarrier Trap Adjustment (6-1-1)
↓
Maximum Frequency Deviation Adjustment (6-1-2)
(video output level cal., sync tip carrier adj., deviation setting, white clip and dark clip adj.)
↓
Carrier Leak Adjustment (6-1-3)
↓
Modulator Output Level Adjustment (6-1-4)
↓
Record Current Adjustment (6-1-5)
↓
Playback R-f Amplifier Frequency Response Adjustment (6-1-6)
↓
Noise Eliminator Adjustment (6-1-7)

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-1	Subcarrier Trap	TP-102 (VM1)	1. Connect scope to TP-102. Set scope time base to 20 μs/cm. 2. Set up the color E-to-E mode, using a color-bar signal input 3. Adjust L101 to minimize the color sub-carrier signal as shown in Fig. 6-2-(b).	L101 (VM1)	Color Bar	Oscilloscope
			 *Fig. 6-2.*			
6-1-2	Maximum Frequency Deviation	TP-103 (VM1)	[Clip removal] 1. Terminate the TV (8-Pin) or VIDEO OUT (UHF) connector with a 75Ω terminator. 2. Connect scope to TP-103. Set scope time base to 5 ms/cm. 3. Set up the black and white E-to-E mode, using a telecast TV signal. 4. Adjust white clip and dark clip by R141 and R139, respectively, as shown in Fig. 6-3.	R139 R141 (VM1)	TV Telecast	Oscilloscope
		TP-309 or TP-310 (VD1)	[Video output level calibration] 5. Connect scope to either TP-309 or TP-310. Set scope time base to 20 μs/cm. 6. Play back the stair step portion of the SONY B/W Alignment Tape, with the COLOR⇔B/W select switch set to B/W. 7. Adjust R336 (VD1) for 1 V ± 0.05V (p-p) on the scope.	R336 (VD1)	SONY Align-ment tape	

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
Maximum Frequency Deviation (continued)	TP-104 (VM1)	[Sync tip carrier frequency setting] 8. Remove the input video signal and set up the E-to-E mode. 9. Connect a digital frequency counter to TP-104. Adjust R129 for a 3.3 MHz ± 0.05 MHz counter reading. If a frequency counter is not available, use an oscilloscope and adjust as follows: a. Adjust scope time base for 1 μsec per division (calibrated). b. Set scope controls to obtain a stable trace. A correct carrier frequency of 3.3 MHz is indicated when there are 33 complete sine waves in ten division. Set R129 to produce this indication.	R129 (VM1)	none	Digital frequency counter or Oscilloscope
	TP-309 or TP-310 (VD1)	[Frequency deviation setting] 10. Feed a telecast TV signal to the VIDEO IN connector in the E-to-E mode. 11. Connect scope to TP-309 or TP-310 (terminated). 12. Adjust R123 for 1.0 V(p-p) on scope.	R123 (VM1)	Telecast TV	Oscilloscope
	TP-103 (VM1)	[White clip and dark clip settings] 13. Connect scope to TP-103. Set scope time base to 5 ms/cm. 14. Adjust R139(dark clip) and R141 (white clip) so that the positive excursion of the video signal is clipped at 50 %, while the negative excursion is clipped at the −30 % level, as shown in Fig. 6-3.	R139 (d. clip) R141 (w. clip) (VM1)	Telecast TV	Oscilloscope

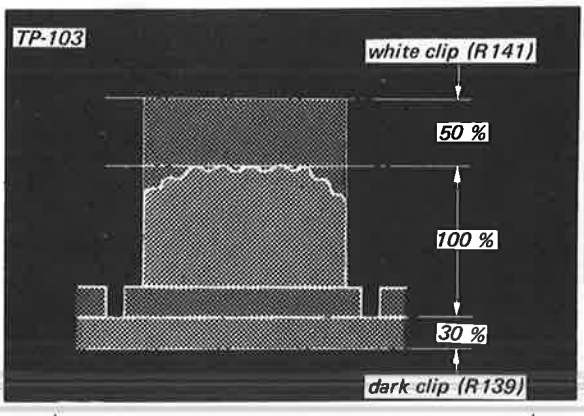


Fig. 6-3.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-3	Carrier Leak	Monitor screen	1. Set up the black and white E-to-E mode using a telecast TV signal or test signal, preferably the camera output of a gray-scale chart. 2. Adjust R311 and R329 for minimum carrier leak (herringbone pattern) on the monitor screen. 3. Adjust R155 and C124 for minimum carrier leak. 4. Repeat Steps 2 and 3 a few times to achieve optimum condition. 5. Record a test signal and play back the tape. Adjust R311 again.	R311 R329 (VD1) R155 C124 (VM1)	Test Signal	Monitor
6-1-4	Modulator Output Level	TP-104	1. Set up the color E-to-E mode using a telecast TV signal. 2. Connect scope to TP-104 and note the amplitude. 3. Set the COLOR-B/W select switch to B/W and adjust R168 so that the amplitude at TP-104 in the black and white mode is equal to that in the color mode.	R168 (VM1)	Telecast TV	Oscilloscope
6-1-5	Record Current		Note, procedure A is the simplified procedure requiring no special equipment. Procedure B is the exact procedure requiring use of a video sweep generator.			
		CH-A (TP-105) CH-B (TP-106) (VM1)	*Procedure A* 1. Connect scope to TP-105 (TP-106), with time base set to 5 ms/cm. Sync the scope externally from TP-406. 2. Set up the record mode. 3. Adjust R174 (R182) for 4.0 V(p-p). See Fig. 6-4.	R174 (CH-A) R182 (CH-B) (VM1)	Telecast TV	Oscilloscope
		CH-A (TP-105) CH-B (TP-106) (VM1)	*Procedure B* 1. Unsolder either end of the lead connected between TP-104 and C135.	R174 R178 (CH-A)	Video Sweep Signal	Oscilloscope

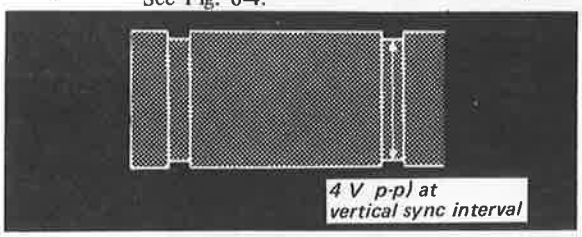
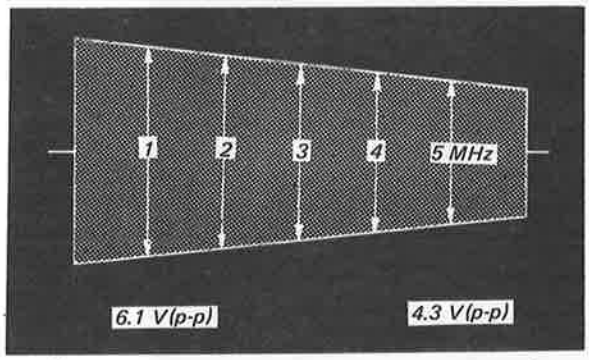


Fig. 6-4.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			2. Feed the video sweep generator output to C135 3. Set the sweep generator output to 0.7V (p-p). Select marker frequencies of 1 MHz and 5 MHz. 4. Connect scope to TP-105 (TP-106) and set up the record mode. 5. Adjust R174 (R182) for 6.1 V(p-p) ± 0.6 V(p-p) at 1 MHz. 6. Check that the signal amplitude at 5 MHz is 4.3 V ± 0.5 V(p-p). If not, replace R178 (R186) with a value in the range of 0 to 20 Ω, and recheck amplitude at 1 MHz. 7. Reconnect the lead removed in Step 1.  *Fig. 6-5.*	R182 R186 (CH-B) (VM1)		
6-1-6	Playback R-f Amplifier Frequency Response	TP-201 (VM1)	Two equivalent amplifiers are used for CH-A and CH-B video heads make adjustment for both channels. 1. Connect scope to TP-201 with time base set to 2 ms/cm. Sync the scope externally from TP-402 (CH-A) or TP-401 (CH-B) on the SV board. 2. Play back the r-f sweep portion of the SONY alignment tape. The five markers in the waveform indicate the 1 MHz, 2 MHz, 3.58 MHz, 4.5 MHz and 5 MHz points, from left to right. 3. Turn R201 (R202) fully clockwise. 4. Adjust C201 (C204) for maximum amplitude at 5.2 MHz. See Fig. 6-6.	R201 C201 (CH-A) R202 C204 (CH-B) R211 L204 (VM1)	SONY Alignment Tape (B/W)	Oscilloscope

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED

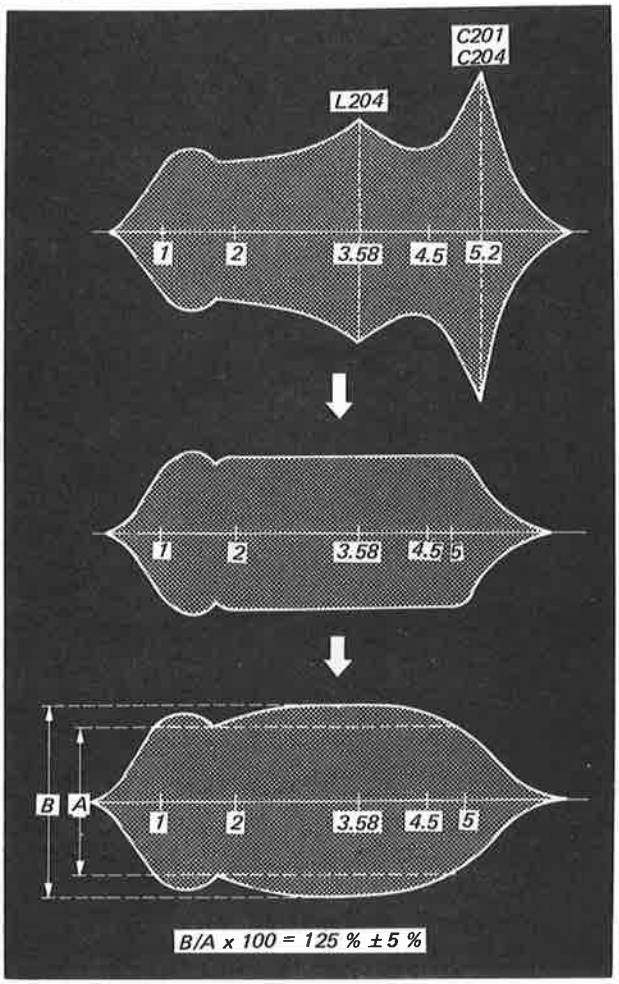
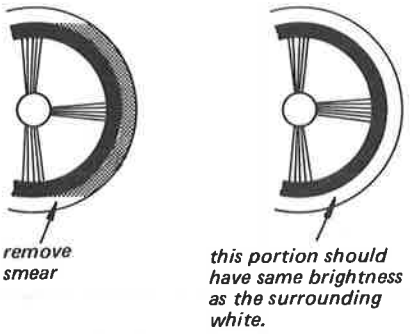


Fig. 6-6.

5. Turn R211 fully clockwise. Adjust L204 to peak at 3.58 MHz.
6. Obtain flat response by adjusting R201 (R202) for 5 MHz amplitude and R211 for 3.58 MHz amplitude.
7. Adjust R211 (Common to Channels A and B) to increase the amplitude B by 25 % as shown in Fig. 6-6.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-1-7	Noise Eliminator	Monitor Screen	1. Record and reproduce the test signal, preferably the camera output of a resolution chart. 2. Turn R353 fully counterclockwise. 3. Decrease the BRIGHTNESS of the monitor. 4. Adjust R353 so that the smear is removed and the portion indicated in Fig. 6-7 has the same brightness as the ambient white. 5. After completing the adjustment, check the portion of the horizontal sync shown in Fig. 6-7 that the amplitude of undershoot is less than 30 % of amplitude of horizontal sync. If not, readjust R353.	R353 (VD1)	Test Signal Preferably Camera Output of a Resolution Chart	Monitor



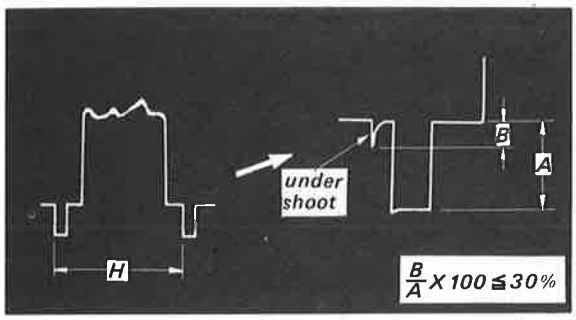
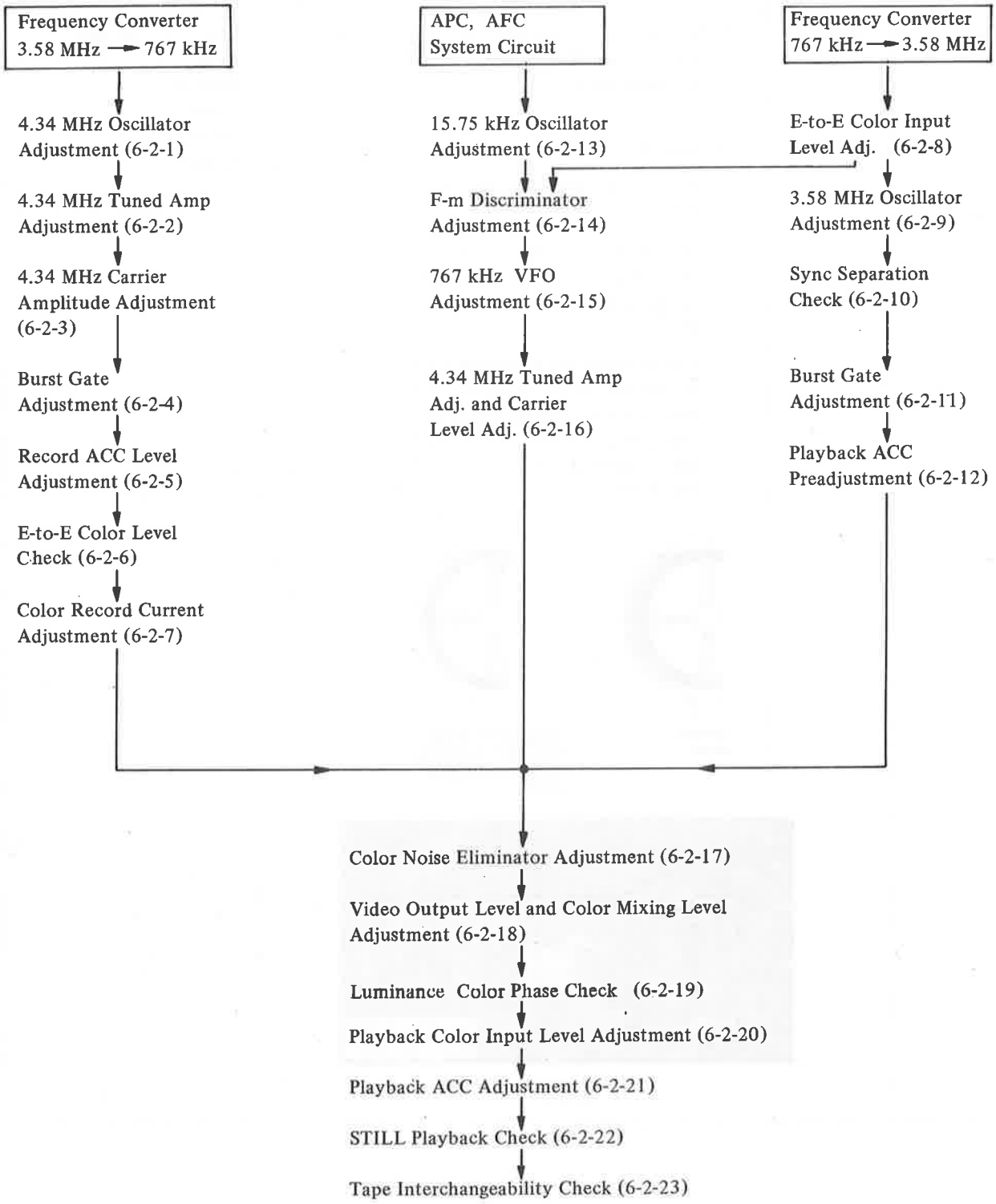
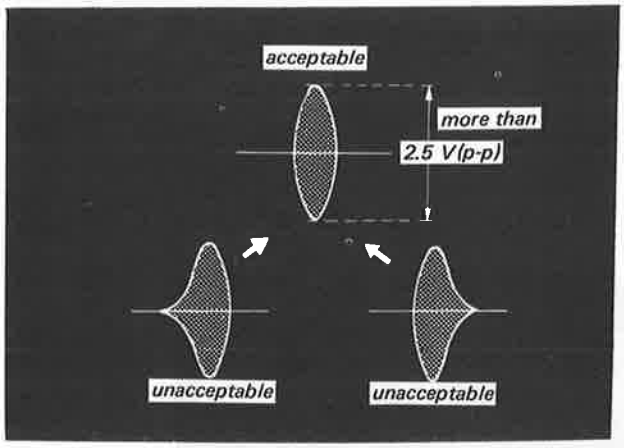
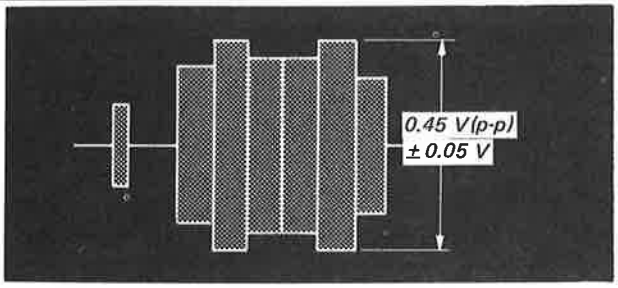
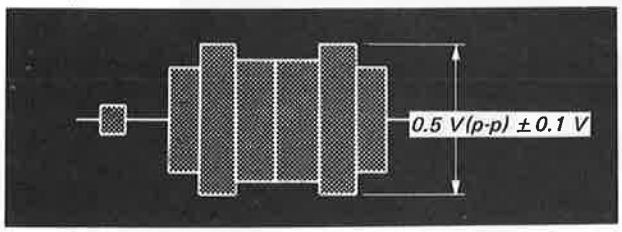


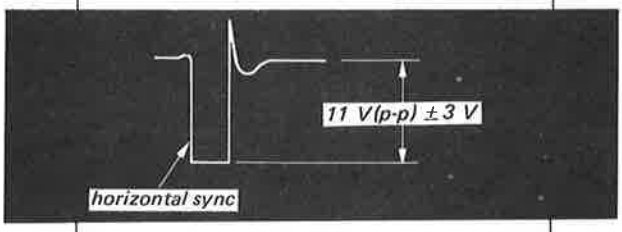
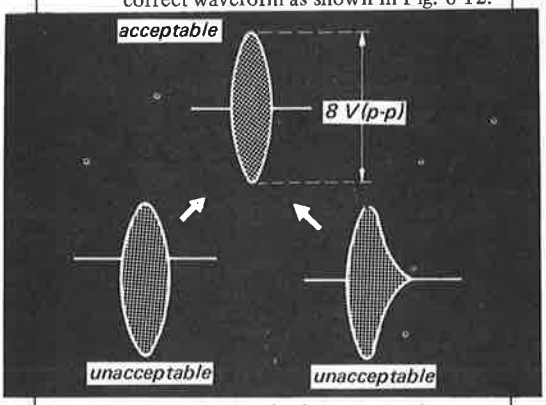
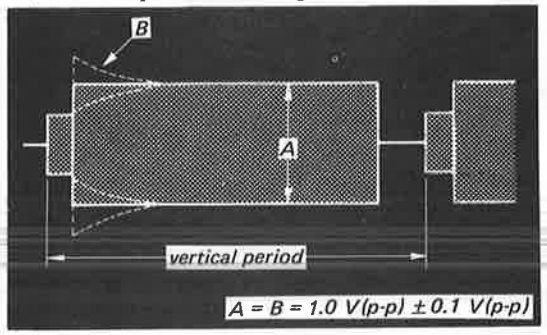
Fig. 6-7.

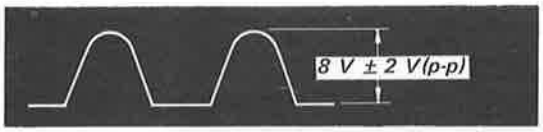
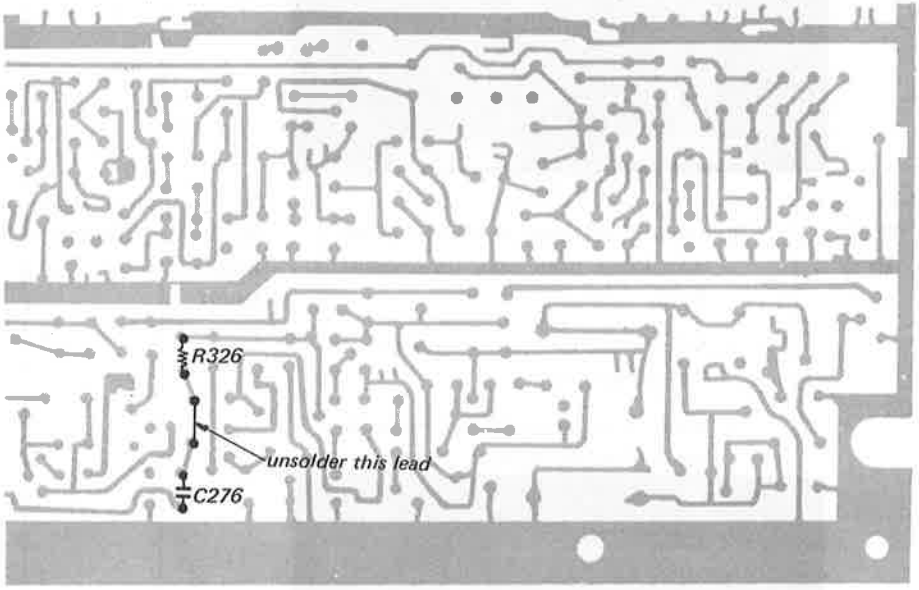
6-2. COLOR SIGNAL ALIGNMENT

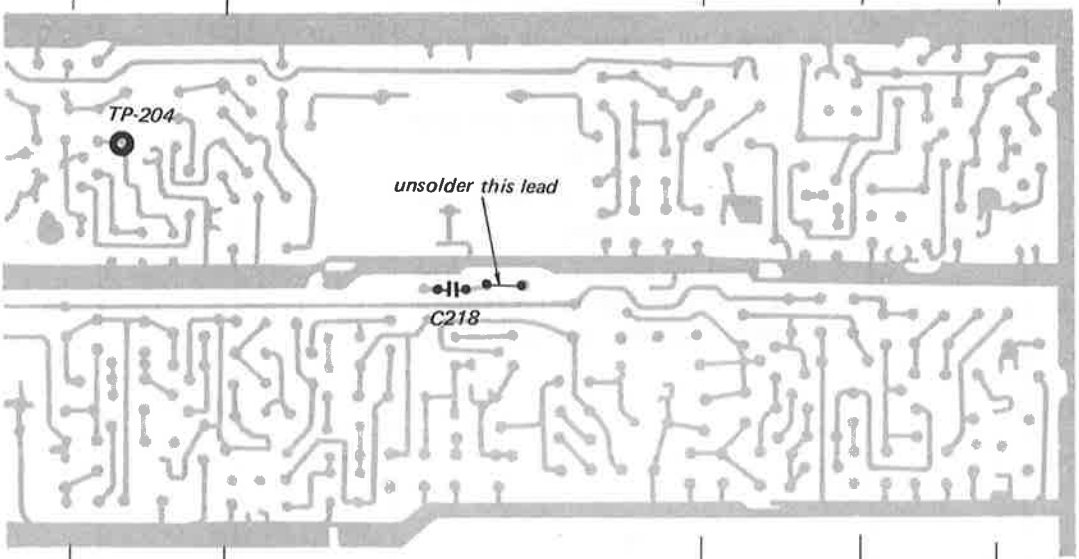


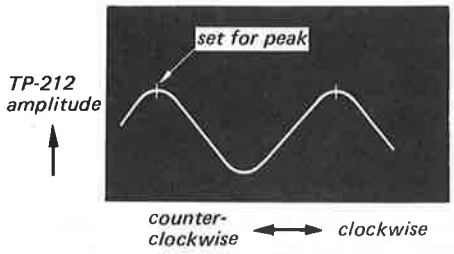
	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Frequency converter 3.58 MHz →767 kHz					
6-2-1	4.34 MHz Oscillator	TP-107 (MC1)	1. Connect a digital frequency counter to TP-107. If the input impedance of the counter is lower than 1 MΩ, connect the scope to TP-107, and connect the counter to scope preamplifier output connector. 2. Set up the color E-to-E mode with no input signal. 3. Adjust C131 for 4.346590 MHz ± 10 Hz	C131 (MC1)	No Signal	Digital Frequency Counter
6-2-2	4.34 MHz Amplifier	TP-107 (MC1)	1. Connect scope to TP-107. 2. Set up the color E-to-E mode. 3. Adjust L105 for maximum amplitude.	L105 (MC1)	No Signal	Oscilloscope
6-2-3	4.34 MHz Carrier Amplitude	TP-107 (MC1)	1. With the same set-up as in Section 6-2-2, adjust R149 for 3.5 V(p-p) ± 0.3 V(p-p).	R149 (MC1)	No Signal	Oscilloscope
6-2-4	Burst Gate	TP-106 (MC1)	1. Connect scope to TP-106 in the color E-to-E mode using a color-bar signal. Adjust L104 and T103 for correct waveform as shown in Fig. 6-8.  *Fig. 6-8.*	L104 T103 (MC1)	Color Bars	Oscilloscope
6-2-5	Record ACC Level	TP-102 (MC1)	1. Connect scope to TP-102, in the color E-to-E mode, using the color-bar signal. 2. Adjust R140 for 0.45 V± 0.05 V(p-p) See Fig. 6-9.	R140 (MC1)	Color Bars	Oscilloscope

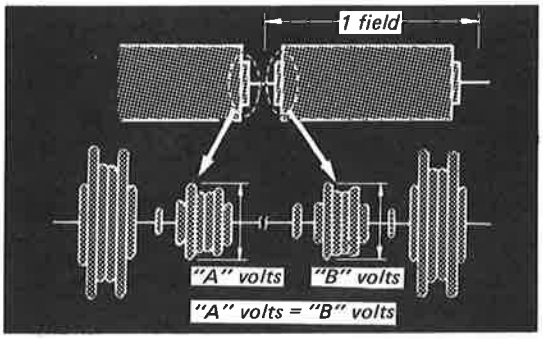
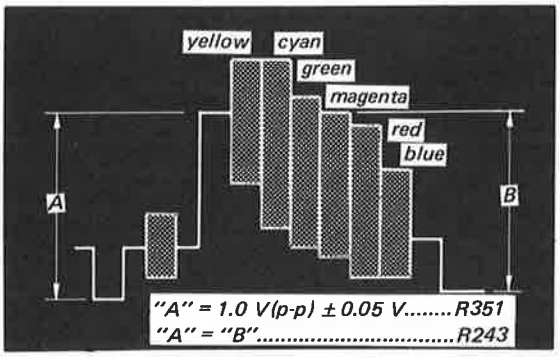
	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			 *Fig. 6-9.*			
6-2-6	E-to-E Mode Color Level Check	TP-103 (MC1)	1. Connect the scope to TP-103 in the color E-to-E mode, using the color bar signal. 2. Check for signal amplitude of 1.1 V ± 0.2 V(p-p).	none	Color Bars	Oscilloscope
6-2-7	Color Record Current	TP-105 (VM1)	Confirm that the record current adjustment of the VM1 Board is correct. Remove the lead wire that is connected to TP-104 on the VM1 Board. Connect the scope to TP-105 or TP-106. Adjust R125 on the MC1 Board for 0.8 ± 0.08 V(p-p). Reconnect the lead wire, after completing adjustment. 6-2-7, Color Record Current.	R125 (MC1)	Color Bars	Oscilloscope
	Frequency converter 767 kHz → 3.58 MHz					
6-2-8	E-to-E Mode Color Input Level	TP-202 (MC1)	1. Connect the scope to TP-202, in the color E-to-E mode, using the color-bar signal. 2. Adjust R202 for 0.5 V ± 0.1 V(p-p).	R202 (MC1)	Color Bars	Oscilloscope
			 *Fig. 6-10.*			
6-2-9	3.58 MHz Oscillator	TP-206 (MC1)	1. Connect the digital frequency counter and the scope to TP-206 in the color E-to-E mode, with no input signal. 2. Adjust frequency for 3,579545 MHz ± 10 Hz and check for amplitude of 3 V(p-p) or more.	C228 (MC1)	No Signal	Digital Frequency Counter Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
6-2-10	Sync Separation	TP-214 (MC1)	1. Connect the scope to TP-214 in the color-E-to-E mode, using the color-bar signal. 2. Check the separated sync signal as shown in Fig. 6-11.  *Fig. 6-11.*	none	Color Bars	Oscilloscope
6-2-11	Burst Gate	TP-208 (MC1)	1. Connect the scope to TP-208 in the color E-to-E mode using the color-bar signal. 2. Adjust the core of T203 to obtain the correct waveform as shown in Fig. 6-12.  *Fig. 6-12.*	T203 (MC1)	Color Bars	Oscilloscope
6-2-12	Playback ACC Preadjustment	TP-203 (MC1)	1. Connect the scope to TP-203, in the color E-to-E mode using the color-bar signal. 2. Adjust R222 for 1.0 V ± 0.1 V(p-p) at "A" in Fig. 6-13. 3. Adjust R323 to obtain "B" amplitude equal to "A" in Fig. 6-13.  *Fig. 6-13.*	R222 R323 (MC1)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Playback ACC Preadjustment (continued)		This is the preliminary adjustment in E-to-E mode. Final adjustment is required in the playback mode. Refer Section 6-2-21.			
			APC, AFC Circuit			
6-2-13	15.75 kHz Oscillator	TP-216 (MC1)	1. Unsolder either end of the lead connected between C276 and R326. See Fig. 6-15. 2. Connect the digital frequency counter and the scope to TP-216 in the color E-to-E mode. 3. Adjust R331 for 15,734 Hz ± 100 Hz and check amplitude. Reconnect lead wire after adjustment.	R331 (MC1)	Color Bars	Oscilloscope, Digital Frequency Counter
			 *Fig. 6-14.*			
			4. Adjust R337 for 10 V ± 1 V(p-p), confirming that the frequency counter reading is 15,734 Hz using the color-bar signal.	R337 (MC1)		
			 *Fig. 6-15.*			
6-2-14	F-m Discriminator	TP-217 (MC1)	1. Connect the scope to TP-217. Set the scope INPUT SELECTOR to DC. 2. Set up the color E-to-E mode using the color-bar signal.	R348 L213 (MC1)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	F-m Discriminator (continued)		3. Turn R348 fully counterclockwise. 4. Adjust L213 (from the component side of the board) for 0 V ± 0.1 V(d-c). 5. After completing adjustment, the 767 kHz VFO adjustment (6-2-15) should be made.			
6-2-15	767 kHz VFO	TP-209 (MC1)	1. Connect the scope to TP-209. Set the scope INPUT SELECTOR to DC. 2. Unsolder either end of the lead connected between C218 and TP-204. See Fig. 6-16. 3. Adjust R346 for 2.5 V ± 0.1 V(d-c).	R346 (MC1)	Color Bars	Oscilloscope
			 *Fig. 6-16.*			
		TP-210 (MC1)	4. Using a hex alignment tool, adjust L208 for 767.045 Hz ± 100 Hz 5. Reconnect the lead unsoldered in Step 1.	L208 (MC1)	Color Bars	Digital Frequency Counter
6-2-16	4.34 MHz Tuned Amp. and Carrier Level	TP-211 (MC1)	1. Connect the scope to TP-211 in the E-to-E mode using the color-bar signal. 2. Adjust L209 for maximum amplitude.	L209	Color Bars	Oscilloscope
		TP-212 (MC1)	3. Turn the cores of L210 and L211 fully counterclockwise. Then turn them clockwise and set them to the first tuned frequency that produces maximum output, since the amplifier has two tuned frequencies.	L210, L211		

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
4.34 MHz Tuned Amp. and Carrier Level (continued)		 *Fig. 6-17.*			
	TP-204 (MC1)	4. Connect the scope to TP-204. 5. Adjust R306 for 4.0 V ± 0.2 V(p-p). 6. Turn L210 clockwise until the signal level is 3 V ± 0.15 V(p-p). 7. Turn L211 counterclockwise until signal level is 2 V ± 0.1 V(p-p).	R306 (MC1)		
	TP-210 (MC1)	8. Connect the scope to TP-210 and measure the signal level. 9. Connect the scope to TP-204. Adjust R306 so that signal level at TP-204 is TP-210 amplitude plus extra 0.2 V.			
6-2-17 Color Noise Eliminator	C504 (C3)	1. Connect the scope to either side of C504, in the color E-to-E mode. 2. Set the scope time base to 2 ms/cm. Pull out the 5X magnifier and adjust the POSITION control to observe the last horizontal line of a field and check the level as shown in Fig. 6-18. 3. Adjust R1506 to equalize the first line of the following field to the last line of the field being observed.	R1506 (C3)	Color Bars	Oscilloscope

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
			 Fig. 6-18.			
6-2-18	Video Output Level and Color Mixing Level	TP-310 (VD1)	1. Terminate the VIDEO OUTPUT receptacle with a 75 Ω terminator. 2. Set up the color E-to-E mode using the color-bar signal. 3. Connect the scope to TP-310. Adjust the luminance level with R351 for 1 V ± 0.05 V(p-p) and color level with R243 as specified in Fig. 6-19.  Fig. 6-19.	R351 R243 (MC1)	Color Bars	Oscilloscope
6-2-19	Luminance Color Phase	Monitor Screen	(This adjustment is necessary only when the delay line is replaced.) DL-201 delays the luminance signal so that the color and luminance signals arrive at the output at the same time. DL-201 contains 10 internal series-strung delay elements that can be connected or disconnected externally as required to provide the correct amount of delay, as may be observed on the monitor screen. 1. Set up the E-to-E mode using the color-bar signal. 2. Check the color monitor screen to determine whether the color signal lags or leads the luminance signal.	DL-201 (MC1)	Color Bars	Color Monitor

ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED

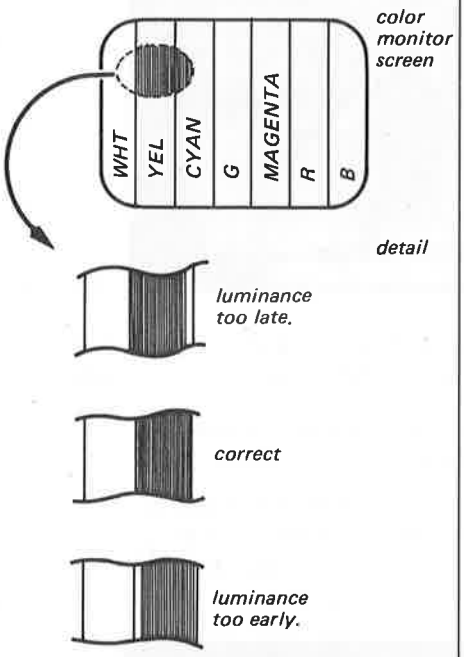
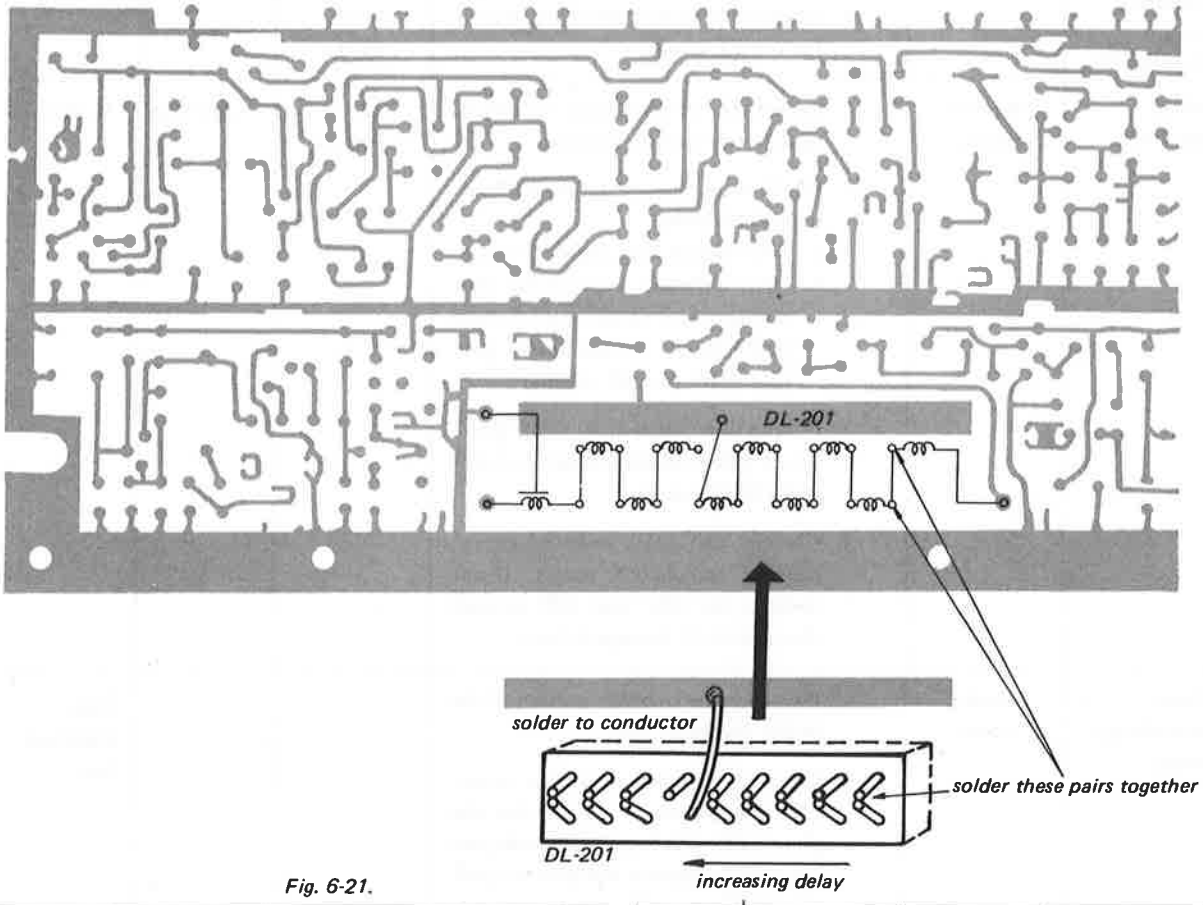


Fig. 6-20.

The delay line terminals are arranged in pairs which, when connected together (starting from the extreme right pair and on consecutively toward the left) add delay elements, thus increasing delay time. To adjust the delay, display a color bar pattern on the monitor. If the luminance signal precedes the chrominance signal (luminance too early), decrease the number of series-connected elements. If the luminance signal is too late, increase the number of series-connected elements.

For example, if six delay elements need to be connected in series, solder the first five pairs of upper and lower taps to each other and solder the lower tap of the sixth element to the conductor as shown in Fig. 6-21. Luminance delay time increases with the number of elements strung from right to left.

ADJUST MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
		 Fig. 6-21.			
6-2-20	Playback Color Input Level	TP-202 (MC1)	1. Thread a blank tape and record the color-bar signal for two to three minutes. 2. Connect the scope to TP-202 and play back the tape. 3. Adjust R202 for 0.5 V ± 0.1 V(p-p).	R202 (MC1)	Color Bars	Oscilloscope
6-2-21	Playback ACC	TP-203 (MC1)	1. Record the color-bar signal on a blank tape for two to three minutes. 2. Connect the scope to TP-203 and play back the tape. 3. Adjust R222 so that "A" of Fig. 6-22 is 1.0 V ± 0.1 V(p-p).	R222 (MC1)	Color Bars	Oscilloscope

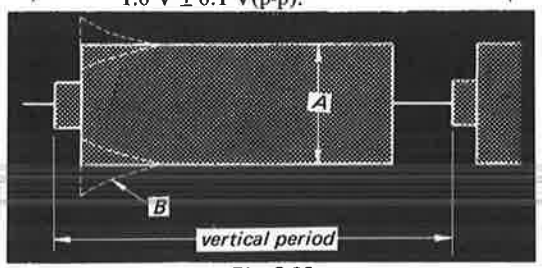


Fig. 6-22.

	ADJUST-MENT	TEST POINT (BOARD)	PROCEDURE & VALUE	CONTROL (BOARD)	SIGNAL SOURCE	EQUIPMENT REQUIRED
	Playback ACC (continued)		4. Adjust R323 so that "B" of Fig. 6-22 is 1.0 V ± 0.1 V(p-p).	R323 (MC1)		
6-2-22	STILL Playback	Monitor Screen	1. Record the color-bar signal on a blank tape for two to three minutes. 2. Play back the tape and put the VTR into the PAUSE mode. a. Color should lock within 1 second. b. Phase difference between the color and luminance signals on the monitor screen should be less than 1 μsec (i.e., 3/16″ on a 12″ screen.) 3. If color does not lock in, adjust R337 (15.75 kHz oscillator output level adj.) in the PAUSE mode. 4. Confirm that color locks in normal playback and PAUSE modes. If not, readjust the AFC and APC systems (Section 6-2-13 through 6-2-16).	R337 (MC1)	Color Bars	Monitor
6-2-23	Tape Interchange-ability	Monitor Screen	1. Play back the color-bar portion of the SONY alignment tape. 2. Check the monitor screen for correct color reproduction. Check that the phase difference between the color and luminance signals is less than 0.5 μsec (i.e., 1/16″ on a 12″ screen).			Color Alignment Tape

SECTION 7

SERVO AND PULSE SYSTEM ALIGNMENT

The servo and pulse system alignment procedure and sequence are shown below.

Section 7-1 **Record Mode Servo Alignment**

Drum Free-Running Speed Check (7-1-1)

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Pulse Symmetry Adjustment (7-1-2)

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Gate Pulse Lock Phase Adjustment (7-1-3)

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Lock Phase Adjustment (7-1-4)

↓

Servo Hunting Adjustment (7-1-5)

↓

Section 7-2 **Playback Mode Servo Alignment**

CTL Pulse Check (7-2-1)

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Tracking Control Calibration (7-2-2)

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PG Pulse Delay Time Adjustment (7-2-3)

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30 PG Coil Position Setting (7-2-4)

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30 PG Coil Dihedral Adjustment (7-2-5)

EQUIPMENT REQUIRED:

Digital Frequency Counter:	Hewlett Packard HP-5245-L, or equivalent
Oscilloscope:	Tektronix type 422, or equivalent
Monitor/receiver:	SONY CVM-1200UA, or equivalent
SONY Alignment Tape:	SONY Part No. 8-943-508-40